



SOUND TRANSIT

POINT DEFIANCE BYPASS PROJECT INCIDENT REVIEW

NOVEMBER 11, 2019

Final Report

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INTRODUCTION

Following its investigation of the December 18, 2017 Amtrak derailment from a bridge near DuPont, WA (“**Amtrak derailment**”), the National Transportation Safety Board (**NTSB**) made recommendations to the Central Puget Sound Regional Transit Authority (**Sound Transit**). Sound Transit is addressing these NTSB recommendations in part by contracting with an independent third-party to conduct an **incident** review of the Amtrak derailment. The review emphasizes the Sound Transit **safety** and **security** certification process utilized for the Point Defiance Bypass Project (**PDBP**).

Throughout this report, terms included in the Acronyms & Definitions section are **bolded** upon first use.

This Incident Review Report is organized into the following sections:

Section 1: Background of the Accident and NTSB Investigation

Section 2: Approach to the Incident Review

Describes the step-by-step approach utilized to identify any deficiencies in Sound Transit’s PDBP’s **safety risk management** and **safety certification** processes, and to develop recommendations to address identified deficiencies.

Section 3: Federal and State Regulations and Industry Practice in Safety Certification

Reviews applicable Federal and State regulations, rules and industry practices, and an inventory of commuter rail **systems**’ safety certification programs.

Section 4: Sound Transit Safety and Security Certification Program

Reviews Sound Transit’s safety certification program, including the agency’s safety-related plans and PDBP documents, and the interviews conducted with Sound Transit staff involved in the PDBP and its safety certification program.

Section 5: Gap Analysis and Findings

Provides a gap analysis and associated set of findings based on Sections 1 through 4 that identify strengths and deficiencies associated with Sound Transit’s safety certification program.

Section 6: Summary and Recommendations

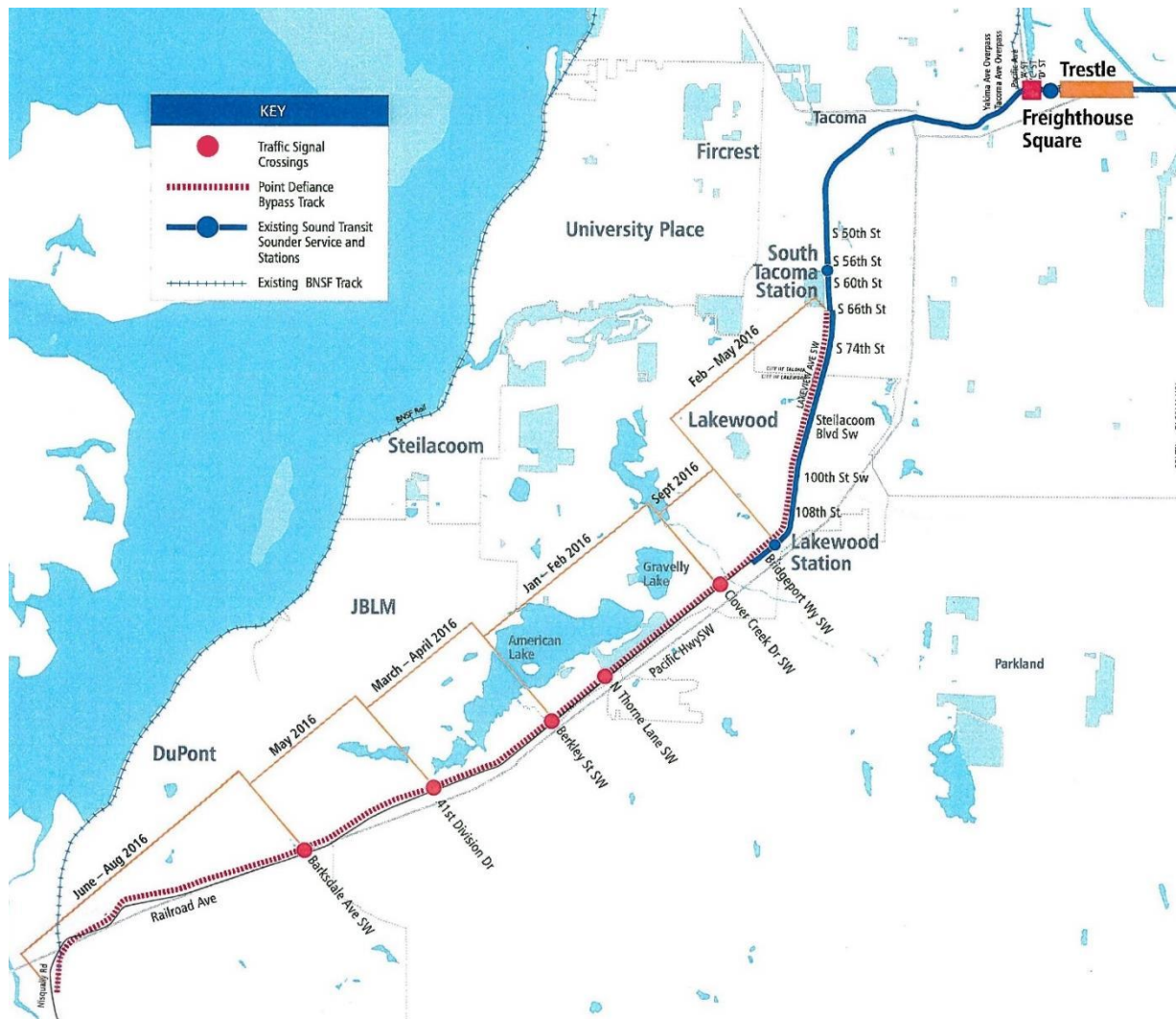
Provides a summary of this incident report and recommendations to address gaps and deficiencies identified in the Section 5 gap analysis and findings.

1 BACKGROUND

In 2006, the Washington State Department of Transportation (WSDOT) developed its long-range plan for improving Amtrak Cascades service between Vancouver, British Columbia, and Portland, Oregon. WSDOT applied for and received federal American Recovery and Reinvestment Act (ARRA) intercity high-speed rail grants in 2009 and 2010 to undertake the first set of improvements included in their long-range plan. After being awarded approximately \$751.5 million in funding, WSDOT began 20 rail infrastructure projects, including the PDBP.

The \$181 million PDBP was WSDOT's final project under the ARRA grant funding package. Initiated in late 2014 and completed by the 2017 grant funding deadline, the purpose of the PDBP was to improve passenger train reliability by reducing congestion with freight trains and travel times, by means of re-routing existing service to an inland route, as shown in Figure 1 below.

Figure 1. Point Defiance Bypass Project (2017)



Sound Transit was the contractor for WSDOT on the construction of the PDBP. Sound Transit in turn hired contractors to undertake the construction work while performing the safety certification in-house. Sound Transit completed safety certification of the PDBP in accordance with the agency's 2015 Safety and Security Management Plan (**SSMP**).

The Sound Transit Safety and Quality Assurance (**SQA**)¹ Department provided the PDBP Safety Certification Verification Report in October 2017, which included the signed Certificates of Conformance. This report was accepted by the Rail Activation Committee (**RAC**). By accepting the PDBP Safety Certification Verification Report, Sound Transit only certified that the PDBP was ready for WSDOT and Amtrak to initiate pre-revenue testing, not that the pre-revenue testing was completed. After pre-revenue testing was completed, Sound Transit did not receive any reports from Amtrak or WSDOT of issues with the operating system. The PDBP Safety Certification Verification Report was not updated to reflect completion of the pre-revenue testing or of operational readiness.

On December 18, 2017, Amtrak began its inaugural operation of the PDBP revenue service. At approximately 7:33 am Pacific Standard Time that morning, westbound Amtrak Train #501 was on single main track from Tacoma when it approached a 30-mph curve at too high of a speed and derailed at milepost 19.8 on the Lakewood sub-division near DuPont, Washington. Several passenger cars fell from a bridge at the curve onto Interstate 5 and hit highway vehicles. The train consisted of two locomotives and twelve passenger cars. Three Amtrak passengers died in the accident and multiple people were injured.

The NTSB conducted an investigation of the Amtrak Train #501 derailment and issued its Accident Report on May 21, 2019². The NTSB's determination of the probable cause of the derailment was Sound Transit's "failure to provide an effective **mitigation** for the hazardous curve without positive train control in place, which allowed the Amtrak engineer to enter the 30-mph curve at too high of a speed due to his inadequate training on the territory and inadequate training on the newest equipment. Contributing to the accident was the Washington State Department of Transportation's decision to start revenue service without being assured that safety certification and verification had been completed to the level determined in the preliminary hazard assessment."

Based on its investigation, the NTSB Accident Report includes both new and reiterated recommendations to the Federal Railroad Administration (**FRA**), and new recommendations to Amtrak, WSDOT and Sound Transit. The three recommendations specific to Sound Transit are:

Immediately conduct a review of all operating documents and ensure that safety mitigations are applied with uniformity throughout the entirety of your territory. (R-19-030)

In areas of your territory where you are a host of a tenant railroad, coordinate with all current and any prospective tenants on the development of operating documents including timetables, general orders, and special instructions. (R-19-031)

Review your internal process for safety certification and verification, perform a gap analysis, and develop an action plan to address the deficiencies identified in the gap analysis and detailed in this report to enhance the verification activities on projects. (R-19-032)

¹ Since the Amtrak derailment, the Sound Transit SQA Department changed its name to the Safety and Quality Management (SQM) Department. This incident review report uses SQA for consistency with PDBP documentation.

² The full NTSB Accident Report is available at <http://www.nts.gov/investigations/AccidentReports/Reports/RAR1901.pdf>.

2 APPROACH TO THE INCIDENT REVIEW

Safety certification is the series of processes that collectively verify the safety readiness of a project for public use. Sound Transit's safety **risk** assessment program uses safety certification to verify the risk mitigation outcomes of the program. To comprehensively evaluate Sound Transit's safety certification process, this incident review evaluated the agency's process to determine:

- **Identified hazards:** The design and operating safety **hazards** on the PDBP alignment.
- **Analyzed risks:** The evaluated risks associated with the identified design and operating hazards.
- **Proposed mitigations:** The measures proposed to address and mitigate the evaluated risks.
- **Verification of safety certification:** The verification means used to determine operational readiness from the standpoint of safety certification.

The incident review approach is comprised of the following seven steps:

Step 1: Confirm Project Scope and Approach

The review team and Sound Transit held an incident review kick-off meeting to discuss the schedule, identify safety risk management and safety certification related documents for review, identify specific Sound Transit staff to be interviewed, and coordinate logistical items for the on-site visit. Refer to Appendix A for the minutes from the kick-off meeting.

Step 2: Review the PDBP Safety Management and Safety Certification Documents

To develop an understanding of the Sound Transit safety risk identification and mitigation process, the review team began by reviewing the Sound Transit SSMP for the PDBP. The review team next examined the Sound Transit Safety and Security Certification Plan (**SSCP**) to gain an understanding of the agency's verification process. These reviews also defined the roles and responsibilities in Sound Transit's safety management and safety certification programs and processes. Additional document reviews included memos, meeting minutes, hazard analyses, and other documents related to the safety risk management and safety certification processes, such as the PDBP's contractual relationship between Sound Transit and WSDOT.

The review team then evaluated Sound Transit's safety management and safety certification documents against relevant Federal guidance documents, including Federal Transit Administration (**FTA**)'s *Handbook for Transit Safety and Security Certification*³, *Safety and Security Management Guidance for Major Capital Projects*⁴, and industry best practices documents.

Step 3: Conduct Sound Transit Staff Initial Interviews

Following the documents review, the team conducted an on-site visit to interview Sound Transit staff who were involved in the safety risk management and safety certification processes for the PDBP. These Sound Transit staff interviews also provided insight into the contractual relationship between Sound Transit and WSDOT for the PDBP. The team interviewed staff from the following Sound Transit departments:

³ Available at <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/SSC.pdf>.

⁴ Available at https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_C_5800.1SSMP.doc.

- SQA
- Design, Engineering and Construction Management (**DECM**)
- Sound Transit Operations
- Rail Activation
- Legal

Step 4: Perform Gap Analysis

Using information and insights developed through the document reviews and staff interviews, the review team performed a gap analysis of the following:

- Safety risk management and safety certification processes used for the PDBP, compared to FTA and FRA regulations and current industry practices.
- Appropriate identification, evaluation, and mitigation of hazards throughout the PDBP lifecycle.
- Verification process for assuring that the mitigation measures were implemented prior to entering passenger service.
- Final project certification for final certification prior to entering into passenger service, including responsibilities, signoffs, and the documentation process.
- Open items process for how, when mitigations are not implemented as envisioned, alternate solutions or “work arounds” are identified and implemented to achieve the level of safety required for passenger service.
- Sound Transit staff responsibilities and capabilities for the safety-related elements of the PDBP.

Step 5: Review Safety Certification Roles and Responsibilities

The review team conducted follow-up interviews with staff with roles and responsibilities in the safety risk management and safety certification processes for the PDBP. Results from these interviews informed the gap analysis of staff roles and responsibilities.

Step 6: Review Regulatory Requirements and Consider Gaps

To establish if Sound Transit’s safety management and safety certification processes meet regulatory requirements, the review team compared the FTA and FRA regulatory requirements for safety and security certification against the processes the PDBP used. The review included an assessment of whether Sound Transit also met the state of the industry current practice. Findings from this review informed a safety certification requirements and industry current practice assessment gap analysis.

Step 7: Develop Incident Review Report

The review team used results from Steps 1 through 6 to provide a draft report of incident review findings to the Sound Transit Chief Executive Officer (**CEO**) and other Sound Transit staff, as designated by the Sound Transit CEO. After incorporating Sound Transit’s review comments, the team provided a Final Report to the Sound Transit CEO that identifies gaps and deficiencies in Sound Transit’s safety risk management and safety certification processes, and recommendations to address the identified gaps and deficiencies.

3 FEDERAL & STATE REGULATIONS & INDUSTRY PRACTICE IN SAFETY CERTIFICATION

System safety, which encompasses safety certification, is primarily a management tool stressing systematic hazard identification and mitigation of associated risks to an acceptable level through planning and effective use of resources. The success of system safety depends on a structured system safety program with clear statements of safety objectives, responsibilities, expectations, and requirements to provide assurance of a safe operation. Many industries, including the railroad and public transportation industries, have adopted the use of System Safety Program Plans (**SSPPs**) to formalize the process in a written document.

FTA funded previous Sound Transit projects, for which Sound Transit met all required FTA grant funding requirements, including the SSMP requirements described in Section 1 and in more detail under Section 3.2 below. Sound Transit also utilized the American Public Transportation Association (**APTA**) manual as guidance in developing their own SSPP. As a result, Sound Transit has experience and knowledge of the FTA's system safety program.

FRA administered the PDBP's federally funded intercity high-speed rail ARRA grant. Typically, FTA handles a commuter railroad project's grant funding and project oversight and, once the project is operational, FRA is responsible for safety oversight. The FRA safety requirements for ARRA grants rely on and align closely with the existing FTA system safety program and APTA guidance described below.

The remainder of this section details Federal and State regulations and industry current practice in safety certification, and how they apply to the PDBP.

3.1 FEDERAL RAILROAD ADMINISTRATION (FRA)

The FRA regulates the safety of railroads in part through a set of regulations at 49 CFR Parts 212 through 242. Specific FRA regulatory topics applicable to the parameters of the PDBP include:

Part 212: State Safety Participation

Part 212.107 – Certification

Part 212.109 – Joint planning of inspections

Part 212.201 to Part 212.235 – State inspector qualifications

Part 217: Railroad Operating Rules

Part 217.7 – Operating rules – filing and recordkeeping

Part 217.9 – Program of operational tests and inspections; recordkeeping

Part 217.11 – Program of instruction on operating rules; recordkeeping; electronic recordkeeping

Part 229: Railroad Locomotive Safety Standards

Part 229.21-Part 229.33 - Inspections and Tests

Part 229.41-Part 229.141 – Safety Requirements

Part 236: Rules, standards and instructions governing the installation, inspection, maintenance and repair of signal and train control systems, devices and appliances

Part 236.1001 – Part 236.1049: Positive Train Control

Part 238: Passenger Equipment Safety Standards

Part 238.111(a) - Pre-revenue service acceptance testing plan for equipment that has previously been used in revenue service in the United States

Part 238.111(b) - Passenger equipment that has not been used in revenue service in the United States

Part 240: Qualification and Certification of Locomotive Engineers

Part 240.123 – Criteria for initial and continuing education

Part 240.129 – Criteria for monitoring operational performance of certified engineers

Part 240.233 – Criteria for the certificate

Part 240.229 - Requirements for joint operations territory

Part 240.231 – Requirements for locomotive engineers unfamiliar with physical characteristics in other than joint operations

Part 242: Qualification and Certification of Conductors

Part 242.301 – Territorial Qualification and Joint Operation

Part 243: Training, Qualification and Oversight for Safety-Related Railroad Employees

Part 243.101-Part 243.113 – Program Components and Approval Process

Part 243.201-Part 243.209 – Program Implementation and Oversight Requirements

For the PDBP, a joint operations territory, Sound Transit is the host railroad and Amtrak is a tenant railroad. As defined by FRA⁵:

Joint operations means rail operations conducted by more than one railroad on the same track regardless of whether such operations are the result of contractual arrangements, an order of a governmental agency or court of law, or any other legally binding directive⁶.

A **host railroad** is a railroad that has effective operating control over a segment of track.

FRA's guidance for the intended meaning of "effective operating control" means the railroad responsible for the installation and maintenance of wayside device and infrastructure, even if dispatching is the contractual responsibility of a different railroad.

⁵ 49 CFR Part 236.1003

⁶ 49 CFR Part 240.7

A **tenant** railroad is a railroad, other than a host railroad, operating on track.

Engineers and conductors must be qualified on territory on which they will operate. The tenant railroad is required to both certify and qualify their operating personnel on the territory⁷. The controlling or host railroad must certify that the tenant railroad's operating personnel are qualified to operate on the host territory. Qualification means that personnel have demonstrated the necessary skills and rules knowledge on the host railroad territory and are familiar with the physical characteristics of the territory⁸.

The host railroad may rely on the certification issued by a tenant railroad⁹. The regulation, however, still requires that the host railroad independently make certain that the operating personnel are qualified¹⁰. Acceptance of a tenant railroad's list of qualified engineers and conductors, in and of itself, does not satisfy the intent of the regulation. The controlling railroad has an obligation to take some action to ensure that the operating personnel are properly trained and qualified on the host railroad territory.

In addition to the requirements of Part 240.229 and Part 242.301, when a controlling railroad accepts the certification of a tenant railroad in lieu of issuing its own certification, FRA recommends that the controlling railroad evaluate the training program of the tenant railroad to ensure that the tenant operating personnel have received sufficient training for operating over the host railroad's line. As the host railroad for the PDBP territory, Sound Transit is required to certify that Amtrak engineers and conductors are qualified to operate on the PDBP territory. At a minimum, Sound Transit should annually receive the training and qualification records of all operating personnel, along with the list of qualified personnel.

In response to several fatal rail accidents between 2002 and 2008, Congress passed the Rail Safety Improvement Act of 2008 directing FRA to, among other things, promulgate new safety regulations that update FRA's approach to safety from its 1994 safety program. FRA responded to Congress by proposing a new rule, 49 CFR Part 270¹¹, that would require commuter and intercity passenger railroads to develop and implement a System Safety Program (**SSP**), formalized in an SSPP, that focuses on the management of safety programs and development of a positive safety culture. The overall requirement for developing an SSP, as documented in the SSMP, closely aligns with the APTA SSMP Manual's recommended SSMP contents. 49 CFR Part 270 would specifically require that the commuter and intercity railroad SSP includes a structured risk reduction program with proactive management processes and procedures to identify and mitigate or eliminate hazards and the resulting risks on the railroad system.

49 CFR Part 270 is divided into four sub-parts, as follows:

Subpart A – General

Subpart B – System Safety Program Requirements

Subpart C – Review, Approval and Retention of System Safety Program Plans

Subpart D – System Safety Program Internal Assessments and External Auditing

⁷ Part 240.229(c)(2) and 242.301(a) and (b)(1)

⁸ Part 240.229(c)(1)(i) through (iv) and 242.301(a) and (b)

⁹ Part 240.229(b) and Part 242.301(a)

¹⁰ Part 240.229(c) and Part 242.301(b)

¹¹ Available at https://www.fra.dot.gov/eLib/details/L18294#p1_z5_gD_ILR.

Subpart B, Section 270.103, requires a description of the railroad's relationship and responsibilities between host railroads and tenant operators, and communication and coordination of the SSP applicable to the host and tenant railroads. Subpart B, Section 270.13, describes the specific requirements for developing the SSPP. Further, 270.13(p) provides the requirements for the risk-based hazard management program to be included in the SSPP.

The FRA published 49 CFR Part 270, the SSP Final Rule, in August 2016, and since then has granted several extensions that most recently delayed its scheduled effective date to March 4, 2020.

In addition to regulations, FRA also issues safety advisories to the railroad industry. On June 12, 2015, FRA issued Safety Advisory 2015-03. The advisory focuses on operational and signal modifications for compliance with maximum authorized passenger train speeds and other speed restrictions. One of the six recommended actions in the advisory was for railroads to survey their entire systems, or the portions on which passenger service is operated, and identify main track locations where there is a reduction of more than 20 mph between the approach speed to a curve or bridge and the maximum authorized operating speed for passenger trains operating on the identified curve or bridge locations.

3.2 FEDERAL TRANSIT ADMINISTRATION (FTA)

FTA provides grant funding to transit systems, including commuter rail systems, for **major capital projects** for both new systems and existing system extensions/expansions. One requirement for grant recipients of these FTA funds is developing an overall Project Management Plan (**PMP**). The SSMP is a required subplan within the PMP. The SSMP is written to describe how the grant recipient will address safety and security in the major capital project from initial project planning through initiation of revenue service. FTA's Circular 5800.1¹² documents the specific requirements for developing the SSMP. Chapter II, Section 2 of the Circular lists the following required safety and security management activities:

- Prepare a policy statement.
- Identify safety and security interfaces for the project.
- Establish a safety and security organization that will manage safety and security activities for the project. The recipient must provide a visual illustration of its safety and security management organization in the form of an organizational chart.
- Identify and carry out specific safety and security activities by project phase. At a minimum, the recipient must:
 - Establish a program for identifying, assessing, controlling, documenting, and tracking safety hazards and security vulnerabilities using formal safety and security analysis techniques.
 - Establish specific safety and security requirements for the project based on applicable safety and security regulations, codes, standards, guidelines, recognized best practices, etc., and verify that all final drawings, specifications and contracts issued for the project conform to these requirements.

¹² Available at <https://www.transit.dot.gov/regulations-and-guidance/circular-final-fta-c-58001-safety-and-security-management-guidance-major>.

- Establish a means for verifying contractor and recipient staff and committees have designed, built, procured, installed, inspected, and tested all facilities, systems, and equipment comprising the project in accordance with the recipient's adopted safety and security requirements.
 - Develop documentation through which it conveys the safety, security, and emergency rules and procedures it has established for project employees, staff, contractors, and oversight agencies.
 - Establish qualifications and training programs that address the safety and security elements of operating and maintenance rules, plans, procedures, manuals and emergency procedures for all personnel who will operate and maintain the project in revenue service.
 - Ensure that it is capable of providing documentation that verifies how the recipient trained and qualified its personnel and/or contractors to operate and maintain the system, and to respond to emergencies. This includes ensuring outside emergency response personnel receive training regarding the project's operations, equipment and emergency procedures.
 - Maintain a process to manage open safety and security items resulting from design deviations, change orders, and non-conformances. The recipient must take action to address and mitigate these issues (through temporary measures if necessary) and to track all open items through closure and acceptance.
 - If applicable, conduct emergency exercises and drills prior to placing the project into revenue service. Drill results must be documented in after action reports.
 - Make final Safety and Security Certification prior to placing the project into revenue service. Certification may be documented in a Final Verification Report.
- Ensure construction safety and security.
 - Ensure coordination with external agencies.
 - Identify safety and security interfaces for the project.

Further, FTA Circular 5800.1 requires grant recipients to develop SSMPs in accordance with Chapter IV, which requires that SSMPs contain the following 11 sections:

Management Commitment and Philosophy towards Safety and Security

- 1.1 Safety and Security Policy Statement
- 1.2 Purpose of SSMP
- 1.3 Applicability and Scope of SSMP
- 1.4 SSMP Goal

Integration of Safety and Security into Project Development Process

- 2.1 Safety and Security Activities
- 2.2 Procedures and Resources
- 2.3 Interface with Management

Assignment of Safety and Security Responsibilities

- 3.1 Responsibility and Authority
- 3.2 Committee Structure
- 3.3 Safety and Security Responsibilities Matrix

Section 4: Safety and Security Analysis

- 4.1 Approach to Safety and Security Analysis
- 4.2 Requirements for Safety and Security Analysis

Development of Safety and Security Design Criteria

- 5.1 Approach to Development of Safety and Security Requirements and Design Criteria
- 5.2 Design Reviews
- 5.3 Deviations and Changes

Process for Ensuring Qualified Operations and Maintenance Personnel

- 6.1 Operations and Maintenance Personnel Requirements
- 6.2 Plans, Rules, and Procedures
- 6.3 Training Program
- 6.4 Emergency Preparedness
- 6.5 Public Awareness

Safety and Security Verification Process (Including Final Safety and Security Certification)

- 7.1 Design Criteria Verification Process
- 7.2 Construction Specification Conformance Process
- 7.3 Testing/Inspection Verification
- 7.4 Hazard and Vulnerability Resolution Verification
- 7.5 Operational Readiness Verification
- 7.6 Safety and Security Certification Requirements

Construction Safety and Security

- 8.1 Construction Safety and Security Program Elements
- 8.2 Construction Phase Hazard and Vulnerability Analysis
- 8.3 Safety and Security Incentives

Requirements for 49 CFR Part 659¹³, Rail Fixed Guideway Systems, State Safety Oversight (if applicable)

¹³ 49 CFR Part 659 is replaced by 49 CFR Part 674, effective March 16, 2019

9.1 Activities

9.2 Implementation Schedule

9.3 Coordination Process

FRA Coordination (if applicable)

10.1 Activities

10.2 Implementation Schedule

10.3 Coordination Process

Department of Homeland Security (**DHS**) Coordination (if applicable)

11.1 Activities

11.2 Implementation Schedule

11.3 Coordination Process

As a sub-plan to the PMP, the SSMP must be developed, reviewed, revised, and submitted each time FTA requires the PMP throughout a project's lifecycle. At a minimum, FTA typically requires the PMP prior to entering each phase of project development: preliminary engineering, final design, construction, testing, and pre-revenue operations. FTA must review and conditionally approve the SSMP, as part of the PMP, prior to the recipient receiving approval to enter the next project phase.

The SSMP is not an SSCP. The SSMP is broader in scope and must describe the project's approach to performing safety and security certification, including the project organization, controls, schedule, and resources dedicated to performing certification and issuing final certificates and reports. The SSMP assures FTA that the project will perform safety and security certification and that the project has sufficient resources, personnel, and technical capacity to carry out the certification program¹⁴.

In 2002 and in partnership with APTA, FTA published the *Handbook for Transit Safety and Security Certification*¹⁵ to provide guidance to recipients on how to address the SSMP's Section 7 requirements for verifying and certifying projects. The Handbook includes tools for properly scoping and defining project safety and developing the SSCP. It provides the following 10-step safety and security certification methodology:

Step 1: Identify Certifiable Elements

Step 2: Develop Safety and Security Design Criteria

Step 3: Develop and Complete Design Criteria Conformance Checklist

Step 4: Perform Construction Specification Conformance

Step 5: Identify Additional Safety and Security Test Requirements

Step 6: Perform Testing and Validation in Support of the SSC Program

¹⁴ For more information on the SSMP, refer to FTA's SSMP Frequently Asked Questions (FAQs) guidance document, available at: <https://www.transit.dot.gov/oversight-policy-areas/safety-and-security-management-plan-ssmp-frequently-asked-questions>.

¹⁵ Available at <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/SSC.pdf>.

Step 7: Manage Integrated Tests for the SSC Program

Step 8: Manage “Open Items” in the SSC Program

Step 9: Verify Operational Readiness

Step 10: Conduct Final Determination of Project Readiness and Issue Safety and Security Certification

3.3 WASHINGTON STATE REGULATIONS

The Washington Utilities and Transportation Commission’s Railroad Safety Section monitors operation of the railroad companies offering service in Washington. The Section conducts safety inspections of various aspects of railroad operation, including crossings and walkways. Under State authority, Section staff evaluate and investigate railroad company-filed petitions related to crossing changes and close clearances, and recommend approval or rejection of the petitions to the Commission. Working with the FRA, Commission staff conduct inspections of company operating practices, hazardous materials handling, crossing signals, and track. The Section also provides education and outreach services as part of FRA’s Operation Lifesaver program. It also investigates accidents and complaints from the public, and partners with local, state, and federal agencies to implement safety awareness and improvement programs.

Specific rules pertaining to railroads are codified at Washington Administrative Code (**WAC**) 480, under three sections:

- WAC 480-60: Railroad companies – Clearances
- WAC 480-62: Railroad companies – Operations
- WAC 480-66: Railroad companies – Sanitation

WAC 480-62 is further divided into five parts:

Part 1: General and Procedural Rules

Part 2: Safety Rules

Part 3: Reporting Requirement Rules

Part 4: Grade Crossing Protective Fund

Part 5: Adoption by Reference

Part 2 includes rules governing track safety standards¹⁶, which reference FRA’s track safety regulation¹⁷. Part 2 also outlines rules for contract crew safety training¹⁸ that require a minimum of eight hours of safety training that includes familiarization with the railroad operating and safety requirements¹⁹.

¹⁶ WAC 480-62-205

¹⁷ 49 CFR Part 212

¹⁸ WAC 480-62-290

¹⁹ WAC 480-62-290(h)(i through iv)

3.4 INDUSTRY PRACTICE IN SAFETY CERTIFICATION

APTA INDUSTRY PRACTICE & GUIDANCE

Sound Transit developed its SSPP using the 2006 APTA *Manual for the Development of System Safety Program Plans for Commuter Railroads* (**APTA SSPP Manual**). The APTA SSPP Manual reflects the current industry practice and guidance on developing and updating SSPPs for commuter rail systems.

In 2016, APTA published the *Safety Management System Manual for Public Passenger Transportation Systems* (**APTA SMS Manual**). The APTA SMS Manual reflects the evolution of the long-standing SSP process, defined in the SSPP, to Safety Management Systems (**SMS**). SMS advances the SSP processes and adds considerable focus to the organization and management of safety throughout the system lifecycle. At the heart of the SSPP is the hazard identification and risk management process. SMS captures and strengthens this critical process by designating Safety Risk Management as one of the core components of SMS.

The review team conducted an inventory of U.S. commuter rail systems and found that:

- Commuter rail systems use the APTA SSPP Manual to guide and inform their safety programs and conduct safety certification/verification of their major capital projects.
- PDBP is unique in its arrangement where the commuter rail system is the host railroad with tenant railroad operators, but does not operate its own service on that territory. No other commuter rail operator has a similar situation as the PDBP.
- Most commuter rail systems that contract their operations to another entity rely on their contractor for safety training of contractor personnel. These systems provide review or oversight of the contractor safety training, requiring the contractor to provide documented evidence of its training program. Typically, the contractor cites its compliance with applicable FRA regulations for engineer and conductor testing and training programs.
- Several commuter rail systems—such as Metra, Caltrain and TriMet’s WES—require additional oversight, such as joint field inspections and periodic reviews of the contractor’s safety data, including personnel testing and training records, as specified in the contract between the commuter rail system and its operating contractor.

4 SOUND TRANSIT SAFETY & SECURITY CERTIFICATION PROGRAM

The scope of the review of Sound Transit’s safety and security certification program is twofold:

- Review applicable plans and other documents.
- Interview staff with roles and responsibilities for the PDBP safety certification program.

This approach enabled the review team to both review the adequacy of Sound Transit’s safety certification program plans against the FTA/APTA *Handbook for Safety and Security Certification* as a benchmark, and to assess how well these plans were followed specifically for the PDBP.

Appendix B lists the set of safety-related plans and other documents that were reviewed for this assessment. This inventory includes:

- **Sound Transit safety program planning documents:** such as the Sounder SSPP, Sound Transit SSCP, and Sound Transit SSMP.
- **Sound Transit reports and other documents specifically for the PDBP:** such as the PDBP Safety Certification Verification Report, PDBP and Tacoma Trestle Rail Activation Plan (**RAP**), and meeting minutes from the Safety and Security Certification Committee.
- **Inter-agency agreements and other documentation between Sound Transit and its PDBP partners:** WSDOT, FRA, Amtrak, **BNSF**, and Tacoma Rail

Appendix C provides the framework used for interviewing Sound Transit staff. The interview framework questions helped guide and inform each interview and prime more detailed follow-up questions applicable to the interviewees’ roles and responsibilities.

Appendix D lists the Sound Transit staff who were interviewed for this incident review.

To facilitate understanding Sound Transit’s safety certification of the PDBP, Table 1 presents a chronology of key PDBP milestones.

Table 1. PDBP Milestones

DATE	MILESTONE
Oct 15, 2016	PDBP trackwork completed
Oct 20, 2016	Systems Integration Test Plan, Volume 1, Point Defiance Bypass, Rev 1
Mid-Summer 2017	Preliminary hazard analysis - overspeed hazard residual rating of “undesirable” approved by RAC (Note: the review team was unable to verify the timeframe for the risk rating change)
Sep 11, 2017	RAP, Rev 1.0
Sep 28, 2017	Sound Transit proposal to start service Dec 17, 2017 (WSDOT agreed and Amtrak did not object)
Sep 30, 2017	End of the federal Fiscal Year deadline for completion of ARRA funded projects
Oct 5, 2017	System Integration Test Plan (SITP) completion and verification certified

DATE	MILESTONE
Oct 24, 2017 to Oct 31, 2017	Sound Transit PDB Safety Certification Verification Report concurrence by Sound Transit Safety, DECM, Operations, Sounder and PDB project departments/offices
Oct 31, 2017	PDBP final acceptance
Nov 11, 2017	Sound Transit Chief Safety Officer recommends to the Sound Transit CEO that the PDBP be considered safety and security certified and that a project safety readiness review was completed for transition to operations.
Nov 18, 2017	Tacoma trestle project substantially completed
Nov 27, 2017	Amtrak starts testing/training locomotive engineers for qualifying on PDBP territory
Dec 5, 2017	Final Report issued by WSDOT for 49 CFR 238.111 pre-revenue service acceptance testing for Sound Transit's Lakewood Subdivision
Dec 18, 2017	Amtrak derailment occurs
Feb 2018	Lakewood Subdivision positive train control (PTC) operational
May 13, 2019	Sound Transit/Amtrak/WSDOT Re-entry to PDB working group meeting
May 21, 2019	NTSB accident report issued

5 GAP ANALYSIS & FINDINGS

Several overarching conditions inform the review team's identified findings and gaps. First, the PDBP is a complex, inter-agency project requiring Sound Transit to closely coordinate with all other project partners: WSDOT, FRA, Amtrak, BNSF, and Tacoma Rail.

Additionally, Sound Transit's experience managing major capital projects is based on FTA grant-funded projects for new and expanded Sound Transit Sounder commuter rail and Link light rail service. Apart from their hazard management program, Sound Transit's safety-related programs and procedures—as documented in their SSPP, SSMP, and SSCP—are based on current industry practices.

Finally, the PDBP represents a new and unique situation for Sound Transit: while Sound Transit is the host railroad, with ownership and effective operating control of the PDBP territory, it does not currently operate its Sounder commuter rail service on this territory. BNSF and Tacoma Rail operate the only existing, but limited, freight service in the territory. Amtrak Cascades passenger service is to be re-routed on this territory.

The gap analysis from this incident review can be categorized into five general areas:

1 PDBP contractual relationships and agreements

Sound Transit's safety managements plans

Sound Transit's hazard management process and procedures

Sound Transit's safety certification process and procedures

Sound Transit's internal departmental coordination for the PDBP

5.1 PDBP CONTRACTUAL RELATIONSHIPS & AGREEMENTS

To understand the obligatory safety requirements on the PDBP, the contractual relationships between the entities involved—the FRA, Sound Transit, WSDOT, and Amtrak—were reviewed.

BACKGROUND

Tacoma Trestle Track and Signal Project

In 2013, Sound Transit secured approval to design and construct the Tacoma Trestle Track and Signal Project. The project was to increase track capacity for Sounder passenger and Tacoma Rail freight trains in Washington between Seattle, Tacoma, and Lakewood through a new connection between D and M Streets in Tacoma. The project involved the replacement of a single-track wooden trestle with a modern double-track structure. Sounder passenger service and Tacoma Rail freight trains were to remain in service during the construction period²⁰.

Completion of the project was originally projected for some time in 2018. Sound Transit; however, was able to obtain Transportation Investment Generating Economic Recovery (**TIGER**) Grant funds from the FTA, to accelerate the design and construction of the project to 2017. The Sound Transit Agency SSMP was the baseline document for the management of the safety aspects for the project, which also incorporated the 2016 Sound Transit Agency SSCP.

²⁰ In 2012, Sound Transit extended its South Line service to Lakewood

Point Defiance Bypass Project

In the 2009-2010 timeframe, WSDOT requested, and was subsequently awarded, approximately \$751.5 million through the FRA High-Speed Intercity Passenger Rail Program and the ARRA to construct improvements for passenger rail service along the Pacific Northwest Rail Corridor (PNWRC). A requirement for accepting funds under the ARRA was for WSDOT to reach agreement with Sound Transit, the owner of the infrastructure in the Lakewood Subdivision (Tacoma to Nisqually), to allow Cascade rail passenger service in the area.

Adding Amtrak Cascade service along the PNWRC required WSDOT to complete improvements to the station, track and signals at Freight House Square. To better coordinate construction of these improvements, WSDOT and Sound Transit entered into construction and maintenance agreements for completing the design and construction of WSDOT's improvements at Freight House Square along with the Tacoma Trestle Track and Signal Project. The agreements also included construction of track, signal, and at-grade crossing improvements from Tacoma to Nisqually. Sound Transit viewed the work as an opportunity to improve the rail infrastructure for its anticipated future Sounder service to Dupont. Sound Transit anticipated project completion by June 2017.

The ARRA grant required WSDOT to prepare a SSPP for the project. As Sound Transit was the owner of the alignment from Tacoma to Nisqually and was involved in the design review and construction of those improvements, FRA accepted the Sound Transit Agency SSMP as satisfying the SSPP requirement. FRA required a safety certification program plan as a component of the SSPP requirement.

Upon project completion, Sound Transit would own and maintain the improvements.

Finding: The FRA requirement for a SSPP was satisfied through Sound Transit's Agency SSMP

Finding: The 2016 Sound Transit SSCP satisfied the safety certification plan component of the SSPP requirement.

RRB 1043 - HIGH SPEED INTERCITY PASSENGER RAIL PROGRAM AMENDED AND RESTATED CONSTRUCTION AND MAINTENANCE AGREEMENT BETWEEN THE STATE OF WASHINGTON, DEPARTMENT OF TRANSPORTATION AND THE CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY

The Construction and Maintenance Agreement was originally executed in November 2014. The agreement allowed for Sound Transit to manage the Point Defiance Bypass Extension on behalf of WSDOT and to reimburse Sound Transit for all costs associated with the construction and construction management of the Extension, in accordance with the ARRA. The agreement was later amended in June 2016 to allow WSDOT and Sound Transit to begin construction of the improvements. WSDOT was to provide Sound Transit a full set of design and specification documents for construction. In turn, Sound Transit, acting on behalf of WSDOT, would seek FRA approval of the construction documents. It was also agreed that Sound Transit would complete all work by June 2017.

Specifically, Sound Transit was to:

- Assist in design development and reviews
- Procure Construction Management / Resident Engineering Consultant

- Advertise, Bid and Award Construction Contract
- Manage Pre-construction and Construction Activities

The latter included Testing, Commissioning, Start-up, and Safety Certification. Sound Transit would be responsible for ensuring that all testing and commissioning of the installed equipment. WSDOT would be responsible for coordinating with Amtrak to make available trainsets to test the entire corridor at design speed, to ensure that the signal system is fully functional, and that the at-grade crossings operate in accordance with the design criteria.

Sound Transit would perform all safety certification tasks of Safety Certification in accordance with the Sound Transit 2016 Agency SSCP, in order to verify the safety readiness of the Extension for passenger service.

The agreement also stipulated that Sound Transit would be responsible for maintenance of the Extension infrastructure, in accordance with FRA requirements.

Finding: Sound Transit was responsible for the testing and commissioning of the Extension infrastructure.

Finding: WSDOT was responsible for coordination with Amtrak, including making available trainsets in order to ensure the functionality of the rail alignment.

Finding: Sound Transit was responsible for verifying the safety readiness of the rail alignment, in accordance with the Sound Transit Agency SSCP.

RRB 1044 – SERVICE OUTCOME AGREEMENT AMONG THE STATE OF WASHINGTON, DEPARTMENT OF TRANSPORTATION, NATIONAL RAILROAD PASSENGER CORPORATION, AND THE CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY

The Service Outcome Agreement, dated October 1, 2014, sought to define the Cascade service requirements for Amtrak passenger service from MP (**Milepost**) 0.7 (TR Junction) to MP 20.73 (Nisqually), which was owned by Sound Transit²¹. The Service Outcomes Agreement specified the maximum scheduled Amtrak trip time between TR Junction and Nisqually and the maximum track and signal delay (in minutes) per one-way Amtrak trip. Sound Transit, WSDOT, and Amtrak would periodically develop an operating schedule for passenger trains in the rail alignment with input from BNSF and Tacoma Rail. The intent was to minimize any impacts to Sounder and Amtrak operations²².

Sound Transit would also be responsible for dispatching Sounder and Amtrak trains through the corridor. As BNSF was the current dispatcher of Sounder passenger service in other Sounder service areas, including the segment between Tacoma to Lakewood, Sound Transit retained BNSF to provide dispatching services in the entire Lakewood Subdivision.

Finding: Sound Transit, as the owner of the railroad infrastructure between TR Junction and Nisqually, controlled all train movements throughout the Lakewood Subdivision through its train dispatching contract with BNSF.

²¹ The MP 0.7 to 1.99 was in the process of being procured from Tacoma Rail at the time of this agreement.

²² Although not specifically part of this agreement, Sound Transit later retained a BNSF to develop a timetable for Sounder and Amtrak operations within the Lakewood Subdivision, with the aim of minimizing service impacts to Sounder operations.

Finding: Sound Transit retained a railroad consultant to work with BNSF in the development of a timetable for the completed Lakewood Subdivision.

Finding: The Service Outcomes Agreement did not, nor did any other agreement that was made available, outline any safety performance or safety oversight activities for the Amtrak or other passenger or freight service within the Lakewood Subdivision, from TR Junction to Nisqually.

**RRB 1886 - NATIONAL RAILROAD PASSENGER CORPORATION AND WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION FOR THE PROVISION OF PASSENGER RAIL SERVICE 10/1/2017 to
9/30/2018**

This Service Agreement, between the State of Washington and Amtrak, defined the service requirements and financial aspects for the operation of Cascade service for the time period October 1, 2017 to September 30, 2018. The agreement was to ensure high quality service and reimbursement for passenger service provided by Amtrak, through direct observations, efficiency testing, training, and annual employee reviews. It also required Amtrak to comply with the Service Standards and General Guidelines. It required passenger vehicles and locomotives to meet regulatory safety standards, including forward facing and interior facing cameras, but not PTC. It did require Amtrak to report to WSDOT service delays and any injuries to passengers.

Finding: Although the Agreement contained safety provisions for locomotives and rail passenger cars, it did not indicate that WSDOT would exercise any safety oversight activities other than the reporting of incidents that affected service delays and passenger injuries. The oversight responsibility was that of Amtrak.

**RRB 1202 - NATIONAL RAILROAD PASSENGER CORPORATION AND WASHINGTON STATE
DEPARTMENT OF TRANSPORTATION FOR THE PROVISION OF PASSENGER RAIL SERVICE FOR STATE
FISCAL YEAR 2019**

This Service Agreement between the State of Washington and Amtrak defines the service requirements and financial elements for the operation of Cascade service within the State of Washington from July 1, 2019 to June 30, 2020. The agreement was drafted after the Amtrak derailment of December 2017.

To ensure that high quality service was delivered, WSDOT required Amtrak to exercise management oversight of the Cascade operation through direct observations, efficiency testing, training, annual employee reviews, and that Amtrak is to comply with the Service Standards and General Guidelines as incorporated into the agreement. The document also states that WSDOT reserves the right to examine/inspect:

- On board criminal events
- On board security events
- Other criminal or security events that effect Amtrak Cascades service
- Requests for on board assistance from law enforcement
- On board medical events
- Crossing, train, or other accidents involving Amtrak Cascades trains in revenue service

- FRA inspection and audits
- Rules testing
- Rules
- Equipment
- Facilities
- Passenger services

The document also includes statements regarding the use and standards of equipment used for the passenger service, and stipulates that such equipment must meet FRA and Association of American Railroad standards. The document also states that an on-board PTC and inward facing and outward facing cameras must be in each locomotive.

Finding: As a whole, the document is focused on the financial and service delivery aspects of the Cascade service, but does provide for minimally active safety oversight of Amtrak service.

Finding: Document RRB 1202 requires on-board PTC in each locomotive.

5.2 SOUND TRANSIT'S SAFETY MANAGEMENT PLANS

Safety is the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level. This is accomplished through a continuous process of hazard identification and safety risk management. The ultimate goal for a transit agency is to ensure the safety of public transportation customers, employees, and the public who interface with public transportation services.

Safety management plans describe the programs, principles, processes, and procedures for the allocation of resources to identify safety risks and to achieve a condition where safety risks are managed to an acceptable level. The plans define safety requirements and provide guidance and tools for managing safety.

FTA defined safety management plan requirements for major capital projects through Circular 5800.1 - *Safety and Security Management Guidance for Major Capital Projects*, including specific required safety and security activities. These requirements are mandated only for FTA-funded projects over \$100 million.

Similarly, FRA requires the development and implementation of safety management plans for major FRA-funded capital projects. Unlike FTA, however, FRA does not provide specific guidance for what safety management plans must contain. Rather, FRA relies on the safety management plan guidance described in APTA's *Development of System Safety Program Plans for Commuter Railroads* and *Safety Management System Manual – Public Passenger Transportation System, Appendix C – Commuter and Intercity SMS Implementation Guide*.

PDBP SAFETY MANAGEMENT

One of requirements for receiving ARRA grant funds was the development and implementation of a SSPP. As Sound Transit was the owner of the new Cascade service alignment and would be involved in the design and construction of the rail alignment, FRA accepted Sound Transit's Agency SSMP.

For the PDBP, the SSMP dated 2015 was the applicable document, as specifically named in the Construction and Maintenance Agreement between Sound Transit and WSDOT. Accordingly, FTA Circular 5800.1 - *Safety and Security Management Guidance for Major Capital Projects* governed the development of Sound Transit's Agency SSMP.

FTA Safety and Security Management Plan (SSMP) Requirements

The FTA's Circular 5800.1 specifies the safety and security activities that a recipient of FTA grant funds for fixed guideway capital projects in excess of \$100 million must perform and document from initial project planning thorough the start of revenue service. Circular 5800.1 lists the following 11 areas that a recipient of capital grant funds must address in an SSMP:

Section 1 – Management Commitment and Philosophy

State the Safety and Security Policy Statement and the purpose, applicability, scope, and goals of the SSMP.

Section 2 – Integration of Safety and Security into Project Development Process

Describe the safety and security tasks that are to be performed, through all project phases, and the procedures and resources that will be used to support these activities. Identify the protocols for communicating safety and security issues to the project leadership team.

Section 3 – Assignment of Safety and Security Responsibilities

Describe the responsibility and authorities of personnel to perform the various safety and security activities, including a description of the role of involved committees.

Section 4- Safety and Security Analysis

Describe the approach to identifying, analyzing, evaluating, and mitigating safety hazards and security vulnerabilities. Describe the types of safety analyses that are to be performed. Describe how the identified safety and security risks will be communicated to the project team, including who has the ultimate decision-making authority.

Section 5 – Development of Safety and Security Design Criteria

Describe the approach to establishing the safety and security requirements and design criteria, including any standards used in the development of the requirements. Describe how project personnel and contractors will use the requirements in the development of design criteria and how adherence to the safety and security requirements will be accomplished in the project design. Identify the procedures for ensuring changes to design criteria are appropriately reviewed and approved.

Section 6 – Process for Ensuring Qualified Operations and Maintenance Personnel

Describe the process for ensuring qualified operations and maintenance personnel, including core competencies, and the schedule for training and qualifying personnel. Describe, by name, the specific safety, security, and emergency plans, rules, procedures, and manuals that will be developed or revised. Identify emergency exercises, drills, and other activities to be performed to ensure operational readiness. Identify programs to support public safety awareness.

Section 7 – Safety and Security Verification Process

Describe the safety and security verification process for conformance with the safety and security requirements during design, construction, testing/installation, and operational readiness phases of a project, and the process for final project certification.

Section 8 – Construction Safety and Security

Describe the construction safety and security program for a project, including construction safety job hazard analysis and hazards that are unique to the construction phase.

Section 9 – Requirements for 49 CFR Part 659, Rail Fixed Guideway Systems; State Safety Oversight

This section was not applicable to the PDBP

Section 10 – FRA Coordination

Identify the activities that will be performed to comply with FRA regulations and provide a schedule for the performance of these activities.

Section 11 – DHS Coordination

Describe how the project will meet DHS requirements, including the applicable security directives issued by the Transportation Security Administration (**TSA**).

Sound Transit Safety and Security Management Plan (SSMP)

Sound Transit originally issued its Agency SSMP in 2007, which has since undergone several revisions. The SSMP editions relevant to the PDBP incident are 2015 and 2017, and are therefore the only editions reviewed for this report. Both editions of the SSMP appear to comply with the requirements of FTA Circular 5800.1; the 2017 edition incorporates FTA comments on the 2015 edition.

The Sound Transit SSMP is similar to SSMPs of other transit agencies. The plan provides general management, roles and responsibilities, processes and tasks for Sound Transit projects. Sound Transit applies its Agency SSMP to all Link and Sounder federally funded capital projects, regardless of size, and to other projects as recommended by the Director of SQA. Applying the SSMP to all capital projects provides consistency in the identification and management of hazards throughout the Sound Transit operating system.

When a project's plans, management structure, responsibilities and authority, schedules, activities, and/or tasks differ from the agency-wide SSMP, a project-specific plan is developed and appended to the Agency SSMP.

Finding: Sound Transit requires modification of their agency-wide SSMP to reflect “project-specific plans, management structure, responsibilities and authority, schedules, activities, and tasks necessary to integrate safety and security into each phase of a specific (transit) project.”

Project-specific SSMP

The 2015 and 2017 editions of the Sound Transit Agency SSMP focused principally on the FTA-funded Link light rail projects, as these were the primary projects for DECM and SQA staff. Section

10, FRA Coordination, of both editions of the SSMP state that project-specific SSMPs would be developed for projects that fall under the auspices of FRA.

Although the ARRA grant agreement incorporated the 2015 SSMP by reference, revisions of the Sound Transit 2015 SSMP do not reflect the PDBP. A PDBP-specific amendment was not added to the SSMP. In March 2016, the PDBP Project Manager wrote to the Director of SQA requesting that the Agency SSMP, without any revision, be adopted for use on the PDBP and citing the rationale that a hazard analysis was completed for the project and that safety and security certification were well underway. The Director of SQA concurred. As a result, a project-specific SSMP addendum was not developed for the PDBP.

While many aspects of the Sound Transit Agency SSMP were pertinent to the PDBP, there were several differences that met the agency's thresholds for developing a project-specific SSMP. Most notable, the management and coordination relationships between Sound Transit, WSDOT, and Amtrak were unique to the PDBP. WSDOT acted as the liaison between Sound Transit and Amtrak, which is not a relationship common to other Sound Transit projects. Based on review team interviews and documents reviewed, Sound Transit staff did not appear to understand the requirements of being a host railroad. SQA, DECM, and Sounder Operations staff reported that WSDOT was responsible for some of the safety activities. This was not identified in the SSMP. The scope of Sound Transit staff efforts focused on certifying the PDBP track and signals elements, not Amtrak's readiness for passenger service on the PDBP territory. Sound Transit staff felt it was WSDOT's responsibility to oversee and verify Amtrak's readiness for passenger service.

In addition, the commuter rail systems design criteria, applicable standards, and regulatory requirements fall under the FRA, which the Agency SSMP does not reflect. The PDBP also modified Sound Transit internal project management structure and combined some committees, such as the Safety and Security Certification Committee with the RAC. Lastly, as a host railroad, Sound Transit did not meet specific FRA regulatory requirements. Not capturing these unique attributes of the PDBP in a project-specific SSMP, particularly the regulatory requirements, led to an incomplete understanding of the needs to meet revenue service readiness.

Finding: A project-specific SSMP was not prepared for the PDBP. (Section 1 of the Agency SSMP)

Finding: The unique management aspects of the PDBP were not captured in the Sound Transit Agency SSMP. (Section 2 and Section 3 of the Agency SSMP)

Finding: The Sound Transit Agency SSMP did not fully describe the approach to establishing the safety requirements and design criteria, including any standards used in the development of the requirements, for the PDBP. (Section 5 and Section 10 of the Agency SSMP)

Finding: The Sound Transit Agency SSMP did not describe the process for training and qualifying Amtrak operations personnel, including the required core competencies, and the timeline to complete the training and qualification. (Section 6 of the Agency SSMP)

Finding: Sound Transit did not specify the rules and procedures applicable to the PDBP, by name, in the SSMP. (Section 6 of the Agency SSMP)

Finding: Sound Transit did not identify their specific responsibilities as a host railroad of the Lakewood Subdivision.

Sounder System Safety Program Plan (SSPP)

The FRA issued 49 CFR Part 270 – System Safety Program (SSP) for commuter and intercity railroads to develop and implement a SSP to improve the safety of their operations. The rule requires a description of the following program elements:

- Safety roles and responsibilities in the SSP
- SSP implementation process
- Maintenance, repair, and inspection program
- Rules compliance and procedures review
- Emergency management
- Workplace safety, including roadway worker protection and fitness-for-duty
- Public safety outreach
- Accident/Incident reporting and mitigation
- Safety data acquisition
- Contract procurement requirements
- Risk-based hazard management
- Risk-based hazard analysis
- Technology analysis and implementation plan
- Safety assurance, including change management, configuration management, and safety certification
- Safety culture

A major component of the plan is for commuter railroads to describe the relationships and responsibilities between the railroads and the host railroad, contract operators, and shared track/corridor operations. This requirement is to ensure that each entity understand the hazards and safety risks associated with passenger service operations within the territory.

Although 49 CFR Part 270 is currently stayed, Sound Transit developed a draft plan in anticipation of the stay being lifted. The draft reviewed for this report, dated December 2018, only mentions the current Sounder operation from Seattle to Everett to the north, and Seattle to Tacoma to Lakewood to the south. There is no mention of Sound Transit's ownership and maintenance responsibility of the railroad infrastructure between TR Junction and Nisqually. Sound Transit must address the coordination issues between Amtrak (the passenger rail service provider), BNSF (freight rail operator), and Sound Transit (the host railroad) in the SSPP.

Finding: The draft Sounder SSPP, dated December 2018, does not reference Sound Transit's responsibilities as a host railroad between TR Junction and Nisqually.

Finding: The lack of recognition of the Sound Transit host railroad responsibilities suggests there still is a misunderstanding of those responsibilities.

5.3 SOUND TRANSIT'S HAZARD MANAGEMENT PROCESS & PROCEDURES

Hazard analysis and safety risk management are the core processes involved in controlling safety risks. To assist transit agencies, FTA established hazard analysis and safety risk management guidance through its publication *Hazard Analysis Guidelines for Transit Projects*. The FTA guidance is based on the U.S. Department of Defense (DoD) *MIL-STD 882 – System Safety*. *MIL-STD 882* provides a standard, generic method for the identification, classification, and mitigation of hazards. Both the *MIL-STD 882* approach and the *Hazard Analysis Guidelines for Transit Projects* have been fully adopted by transit systems throughout the United States. Consistent with industry practice, Sound Transit also adapted the hazard analysis and safety risk management processes found in the Agency SSMP and the Sounder SSPP from the FTA and DoD documents.

HAZARD ANALYSIS

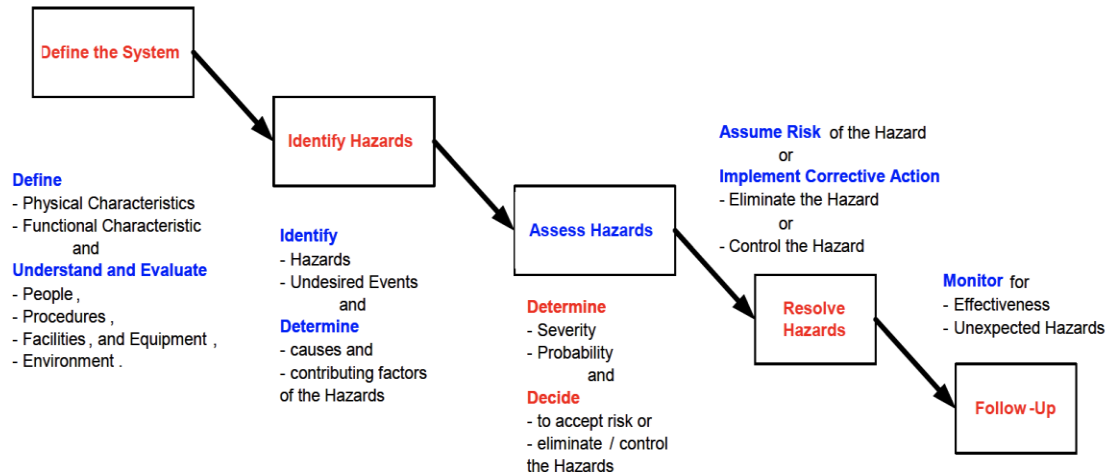
As required by the Sound Transit SSMP, a preliminary hazard analysis (PHA) was conducted at the preliminary engineering phase of the PDBP to identify those hazardous conditions and unplanned events that may lead to death, injury to people, damage to equipment or property, and damage to the environment. The PHA was prepared by a safety consultant, reviewed by Sound Transit SQA staff, and validated by PDBP Design Consultants, Sound Transit DECM staff, Sounder Operations staff, City of Tacoma, City of Lakewood, DuPont Fire, Amtrak, and Tacoma Rail. The Safety and Security Design and Construction Committee (SSDCC) was responsible for reviewing and approving the PHA.

PHA

A review of the PHA in the *Safety Certification Verification Report – Point Defiance Bypass Project*, dated October 27, 2017, found the analysis did not reflect safety risk management industry practice. Furthermore, there appears to be confusion between the safety certification process and the safety risk management process.

The objective of safety risk management is to assess the safety risks associated with the identified hazards/undesired events in order to develop and implement effective and appropriate mitigations to control the safety risks. Safety certification is a process to verify that the proposed controls have been implemented. The safety risk management process is illustrated in Figure 2 below.

Figure 2. Safety Risk Management Process



Hazard assessment is the classification of hazards/undesired events in terms of probability and severity, and then the ranking of the hazard in terms of acceptability.

The Sound Transit frequency definition for “probability” does not conform to the FTA or DoD guidance and industry practice, as shown in Figure 3 and Figure 4 below. For example, the 2015 and 2017 SSMP documents define a Remote hazard/undesirable event as “Unlikely, but can be expected to occur for > 1 event /5 years; < 10 during 10 years”. In other words, the event may occur as frequently as once every five (5) years. This Sound Transit-defined frequency of occurrence is not a Remote event that can be accepted; this is an occurrence with a relative frequency that should be controlled. In contrast, the transit industry defines a Remote event as frequently as once every 10 years. The Sound Transit definition may lead to hazards not being adequately controlled.

Figure 3. Industry Probability Definitions

Description	Level	Potential of a Hazard/Undesired Event Occurring on the Entire Fleet, Inventory, Person, Group, Project or Process/ Task over its anticipated life
Frequent	A	Frequent likelihood of occurrence OR more than 10 times/ year
Probable	B	Probable likelihood of occurrence OR between 1 and 10 times/ year
Occasional	C	Likely to occur occasionally OR between once/ year and once/ 10 years
Remote	D	Remote likelihood but can reasonably be expected to occur OR between once/ 10 years and once/ 100 years
Improbable	E	Improbable likelihood of occurrence, but possible OR less than once/ 100 years

Figure 4. Probability Definitions (2015 Sound Transit Agency SSMP)

Table 4. Hazard Probability Categories

Probability Level	Specific Individual Item	Fleet or Inventory	Frequency
Frequent A	Likely to occur frequently in the life of a system	Continuously experienced	> 1 event / 2 weeks
Probable B	Will occur often in the life of a system	Will occur frequently in the system	> 1 event / month; < 24 events / year
Occasional C	Likely to occur sometime in the life of an item	Will occur several times	>1 event / year; < 5 during 5 years
Remote D	Unlikely, but possible to occur in the life of an item	Unlikely, but can be expected to occur	> 1 event / 5 years; < 10 during 10 years
Improbable E	So unlikely, it can be assumed occurrence may not be experienced	Unlikely to occur, but possible	< 1 event during 20 years

Finding: The Sound Transit frequency definition does not align with transit industry practice.

The review team also found that the definitions in the Agency SSMP for “severity” and “probability” were not consistently applied throughout the PDBP analysis. This inconsistency led to an incorrect conclusion as to the magnitude of the hazard of the curve.

Finding: The definition of severity and probability were not consistently applied in the PDBP PHA.

Also concerning is Sound Transit’s safety risk evaluation of a hazard/undesired event after the application of mitigation measures. Industry practice is to conceptually evaluate a hazard/undesired event as “Acceptable,” “Undesirable,” or “Unacceptable.” Added mitigation measures must support a reduction of the hazard to a level of safety acceptable to Sound Transit. The reduction of safety risk shown in the PDBP PHA does not appear to be justified. For example, the proposed mitigation measures for PHA Hazard 026 – Collision of Train with Structure does not support the reduction of the risk. Another example is PHA Hazard 123 – Derailment for which the hazard was reduced from an “Unacceptable” event to an “Undesirable” event without application of any additional mitigation measures. This approach misstates the actual risk.

Finding: The mitigation measures in the PDBP PHA often do not support the safety risk ranking level of a hazard.

Operating Hazard Analysis (OHA)

An Operating Hazard Analysis (**OHA**) is a required activity under the 2015 Agency SSMP. The purpose of the OHA is to identify and analyze hazards associated with personnel and procedures. The OHA for the PDBP was completed mid-2018, well after the start of revenue service. Many of

the review team's concerns related to risk assessment and evaluation and consistency found in the PHA were also found in the OHA.

Initiating an OHA or incorporating elements of an OHA in the PHA provides an opportunity to control a hazard or undesired event through design.

Finding: The OHA for PDBP was completed well after the start of revenue service.

5.4 SOUND TRANSIT'S SAFETY CERTIFICATION PROCESS & PROCEDURES

The certification methodology described in the 2016 Sound Transit Agency SSCP was developed in accordance with the FTA *Handbook for Transit Safety and Security Certification*. It is a process intended to demonstrate that an acceptable level of safety risk was achieved for Sound Transit Projects.

The Agency SSCP objectives were to:

- Identify, evaluate, resolve safety hazards;
- Identify appropriate safety guidelines and standards for inclusion in design criteria;
- Design, construct, inspect, and test facilities, systems, and equipment in accordance with safety requirements, design criteria, specifications;
- System safety plans, operating and maintenance plans and procedures, rulebook, and training programs were reviewed and updated to incorporate new regulatory requirements, guidance, and industry best practices;
- Personnel were trained and certified to operate and maintain the facilities, systems, and equipment; and
- Emergency response agencies are trained and receive refresher training regarding the inherent hazards of Sound Transit operations and response to Sound Transit emergencies.

Achievement of the above objectives would be demonstrated through a series of conformance checklists:

- Design Conformance
- Construction Conformance
- Testing Conformance
- Operational Conformance

Each performance checklist provides verifiable evidence that the safety requirements were satisfied.

In a March 7, 2016 memo, the PDBP Project Manager requested to utilize the Agency certification plan for the PDBP. The request did not include any revisions or modifications. The Director of SQA confirmed the request.

The PDBP Safety and Security Certification Verification Report (**SSCVR**) was intended to demonstrate that the safety certification program objectives were satisfied through the safety requirement verification process. The PDBP SSCVR, of March 2017, stated:

“The Safety and Security Certification Verification Report enclosed demonstrates that the Point Defiance Bypass Track & Signal Improvements Project between Lakewood and Nisqually is acceptable from a safety and security critical standpoint. All outstanding items from the safety certification program requirements have been identified and mitigated to the lowest practical risk level.”

The statement was based on memos from DECM, Safety, and Sounder staffs stating that all Sound Transit’s responsibilities for safety certification were completed. A limited review of the verification documentation found that not all areas of the Sound Transit’s agency safety certification process were satisfied by the evidence; contrary to the above statement.

Since there was a lack of clearly defined roles and responsibilities among PDBP partners, particularly in regards to safety certification and verification activities, SQA believed the safety certification/verification process was complete as PTC would not be available and that the certification activities were to be principally focused on the design, construction and installation of the track and signal improvements. SQA and the RAC did, however, review and confirm some safety operational aspects as part of the certification process. By accepting the Agency SSMP and Agency SSCP in its entirety for the PDBP, all elements of these plans should have been satisfied. The Operational Conformance element of the Agency SSCP, however, was not fully completed. Furthermore, WSDOT agreement RRB 1043 for safety certification did not limit the scope of the safety certification effort only to the design, construction and installation phases of the project.

Finding: The Operational Conformance phase of the Sound Transit safety certification process was not fully satisfied.

DESIGN CONFORMANCE

PDBP Signal System design documentation appeared to be in order.

Finding: Conformance with the safety requirements for the signal system design was completed.

CONSTRUCTION CONFORMANCE

Conformance with the construction and installation safety requirements for the PDBP track infrastructure elements appeared to be in order.

Finding: Conformance with the safety requirements for the track installation was completed.

TESTING CONFORMANCE

Testing of the locomotives and signal system was completed as part of the safety certification program.

Finding: All required locomotive and signal testing outlined in the Systems Integration Test Plan (SITP) was completed.

OPERATIONAL CONFORMANCE

The Sound Transit Agency SSCP, adopted for the PDBP, did not fully include safety certification operational elements, as would typically be required for all Sound Transit Link Projects. The scope was limited to Sounder related activities and impacts. The Operational Conformance Checklist was limited to requiring:

- Updates to the Sounder Rulebook
- Updates to Sounder operating and maintenance procedures
- Development and completion of a public outreach program related to grade crossings within the Sounder operating segment
- Updates to the Sounder Passenger Train Emergency Preparedness Plan
- Qualified personnel for contracted Maintenance of Way services
- Performance of an emergency exercise for Sounder operations

There was no requirement for BNSF, Tacoma Rail, or Amtrak operating engineers to be trained and qualified in the new operating segment. Furthermore, the review team did not receive evidence verifying the qualification of maintenance of-way service personnel. Verification is particularly important to the inspection and maintenance of the track and signal systems.

Interviews with Sound Transit Safety, Sounder, and DECM staffs identified confusion with responsibilities related to PDBP start-up activities. The departmental staffs believed that WSDOT was responsible for those activities. All Sound Transit departmental staffs reported attempts to obtain information from Amtrak about the training and qualification of their operating personnel for the Cascade service, but no supporting documentation of these requests was provided to the review team. Although Sound Transit received correspondence from Amtrak stating the operating staff was trained and qualified, objective evidence of training and qualification was not provided for review, as required by FRA.

FRA regulations obligate Sound Transit, as the host railroad, to ensure that any tenant railroad's operating personnel are certified and qualified to operate on the host territory. Though Sound Transit may rely on the certification issued by the tenant railroad, Sound Transit is required, as the host railroad, to independently determine that the operating personnel are qualified²³. Acceptance of a tenant railroad's list of qualified personnel is not sufficient. For this reason, Sound Transit should annually receive the training and qualification records of all operating personnel for the Lakewood Subdivision, along with the list of qualified personnel. Additionally, Sound Transit has the responsibility to ensure that the tenant railroad operating personnel are properly trained and qualified for the Lakewood Subdivision. Sound Transit should evaluate the training program of each railroad in the Lakewood Subdivision to ensure the sufficiency of the training.

Finding: Sound Transit Safety, Sounder, and DECM staff believed that WSDOT was responsible for overseeing all activities related to Amtrak training and qualification.

Finding: The PDBP operational conformance checklist was limited to updating the Sounder rulebook and related SOPs; updating the Passenger Train Emergency Preparedness

²³ Part 240.229(c) and 242.301(b)

Plan; and requiring that contracted Maintenance of Way services were to be performed by qualified personnel.

Finding: Objective evidence of Amtrak staff training and qualification was not provided to or reviewed by Sound Transit.

Finding: There was no requirement for Sounder and Tacoma Rail operating engineers to demonstrate re-qualification on the new bypass from Seattle to Tacoma.

Finding: FRA regulations require Sound Transit, as the host railroad, to certify the qualifications of all tenant operating personnel.

The Agency SSMP, Agency SSCP, and RAP required pre-revenue operations to demonstrate the training of operating staff and to confirm operating plans. This did not fully occur before revenue service began. Effective pre-revenue simulations should integrate all aspects of revenue service, including equipment to be used (such as locomotives), crews that would be assigned to the revenue service, and use of the timetables. Pre-revenue simulations also have the benefit of identifying safety or other issues that may affect operations.

Finding: Pre-revenue simulated service was not fully performed, as required by the Agency SSMP, Agency SSCP, and RAP.

A requirement of the WSDOT/Sound Transit Construction and Maintenance Agreement was the development of train schedules. The schedules were components of the Cascade service timetable, which also included instructions to crews about any special conditions and cautions. The PDBP timetable specifically called out the curve at MP 19.8 and the need to reduce train speed, well in advance of the curve. The timetable was a safety requirement that should have been part of the safety certification process. Based upon interviews with Sound Transit departmental staffs, there was a belief that Sound Transit was not responsible for the certification of the operational aspects of the project. Consequently, it was not considered part of the certification process.

Finding: The PDBP timetable was not a requirement of the safety certification process.

Finding: The timetable did not require the Amtrak conductor to remind the engineer of the upcoming speed restriction at MP 19.8.

In addition to the timetable, BNSF was requested to place speed signs to advise Amtrak engineers of the operating speeds, and particularly when to reduce train speeds. Advance speed warning signs were placed approximately two miles in advance of curve 19.8 to warn engineers of the sharp curve. The signs, however, were placed in accordance with BNSF railroad standards for freight trains, not passenger trains. Passenger trains require shorter distances to stop than freight trains. Because the advance speed warning sign placement was not suitable for passenger trains, Amtrak engineers did not heed the speed restriction at the sign point. During system integration testing and qualification of Amtrak staff, Amtrak was requested to advise of any operational issues. Despite inappropriate placement of speed restriction signage for passenger rail service, Amtrak reported no operational issues.

Finding: Amtrak did not advise WSDOT or Sound Transit that the advance speed warning signs in the segment between Lakewood and Nisqually were not suitable for passenger train traffic.

5.5 SOUND TRANSIT'S INTERNAL DEPARTMENTAL COORDINATION FOR THE PDBP

Several committees within Sound Transit provide safety and security oversight and direction for Sound Transit projects. Figure 5 shows Sound Transit's safety and security management committees. Figure 6 depicts the safety and security risk approval hierarchy associated with the review and approval process for mitigating hazards.

Figure 5. Sound Transit Safety and Security Management Committees

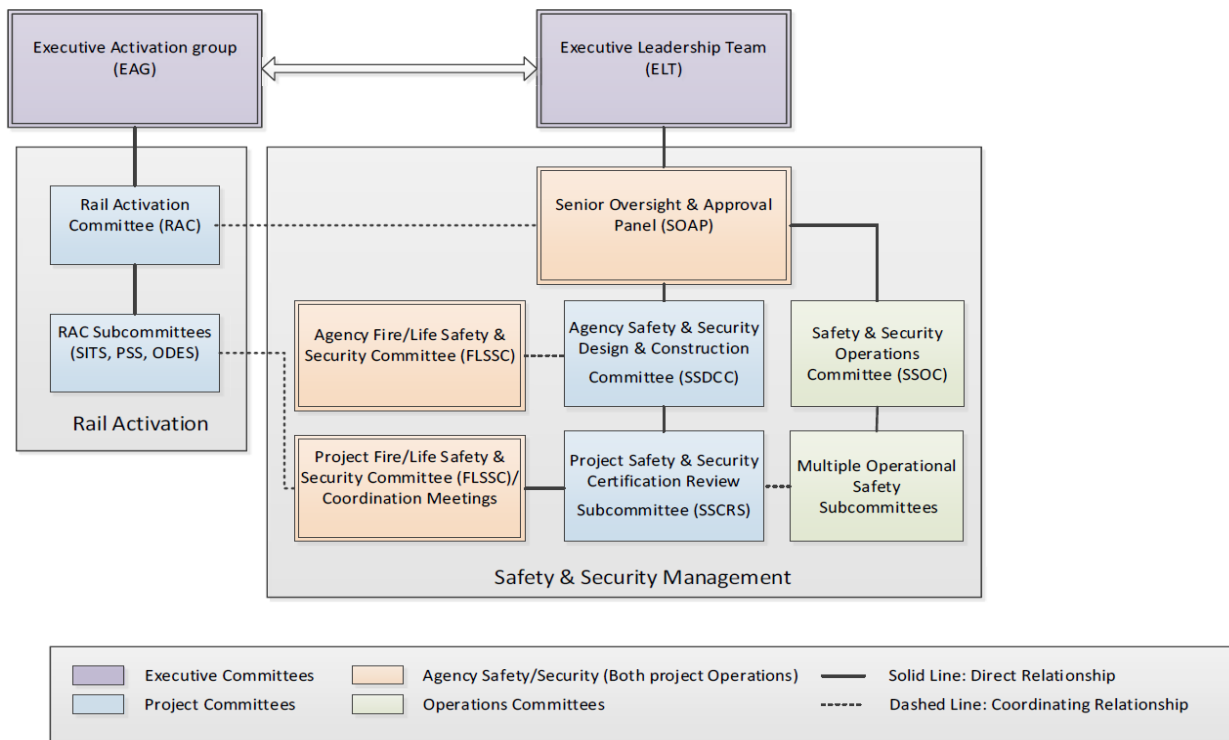
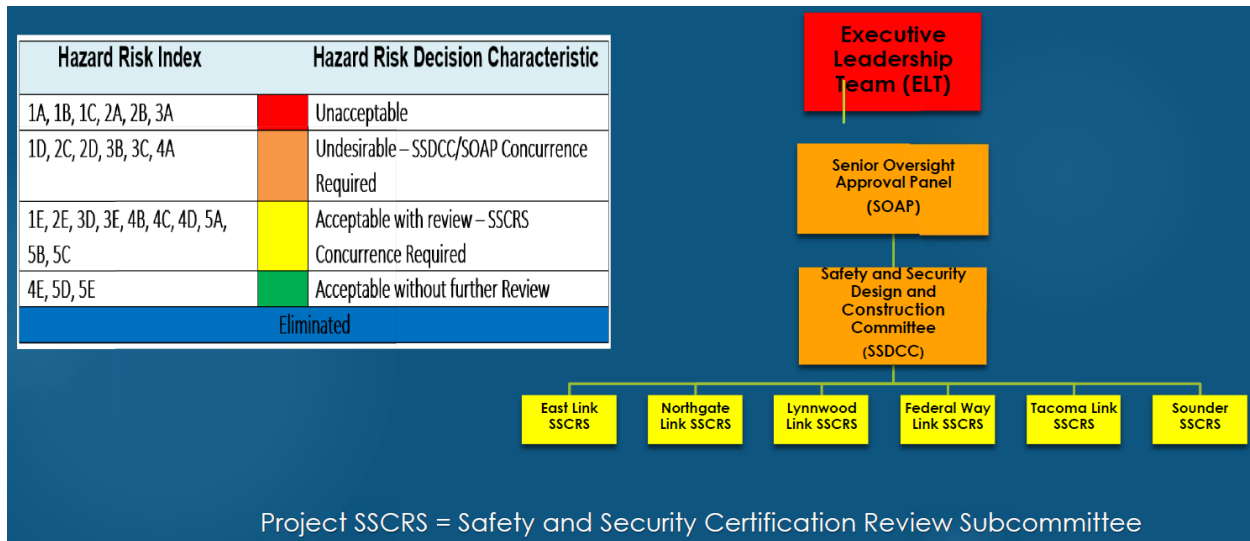


Figure 6. Sound Transit Safety and Security Risk Approval Structure



Sound Transit’s PDBP documentation for recording key decisions and approvals, as provided to the review team, was incomplete and in some cases unclear.

The Agency SSMP assigned responsibility for rail activation safety and security oversight and policy direction to the Executive Action Group (**EAG**). The EAG is comprised of the CEO, Operations Executive Director, Deputy Executive Director of Transportation and Maintenance, Commuter Rail Operations Manager, DECM Executive Director, Deputy Executive Director Project Management, Project Director for Sounder, and Director of SQA. In accordance with the Agency SSMP, the EAG reviews and approves recommendations from RAC approval of safety and security certification of a project. Once approved by the EAG, the System Certification of Conformance is signed by the CEO. For the PDBP, the certification approval process was not followed.

Once the PDBP certification process was completed and sent to the RAC for review and approval, the certification package was not submitted to the EAG for final certification approval and ultimate sign-off by the CEO. Rather, the Project Certificate of Conformance was presented to the Operations Executive Director, DECM Executive Director, and Chief Safety Officer for signature and without the benefit of a formal presentation. A presentation would typically include an overview of the certification process used for a project, an explanation of any hazards rated as “undesirable”, and discussion of any outstanding issues, including the need for workarounds. For the PDBP, the discussion should have included discussion of the delay in implementing PTC and those measures to be taken in the interim.

A November 13, 2017 memo was sent from the Sound Transit Chief Safety Officer to the CEO and Deputy CEO stating that after “*review and examination of available documents from Civil/Facilities, Systems, Construction Management, Operations, and Safety, the Sounder Point Defiance Bypass Project is considered safe and secure for transition to operational use and service. . . It is my recommendation that the Sounder Point Defiance Bypass Project be considered safety and security certified. Concurrence by Operations, Security and Construction Management is demonstrated by the included letters from Sound Transit Commuter Rail Operations Manager, Director of Public Safety, and Project Director, Point Defiance Bypass Track & Signal Improvements Project.*”

Finding: The Sound Transit safety and security certification approval process was not followed for the PDBP.

Finding: The Project Certificate of Conformance was not signed by the Sound Transit CEO, as required by both the Agency SSMP and Agency SSCP.

The RAC for PDBP was not designed to oversee of the integrity of the processes as described in the PDBP RAP and the Agency SSMP. Furthermore, the RAC organizational structure did not permit the RAC Manager to work directly with the EAG, which may have created a gap in communicating the true state of operational readiness.

Finding: The RAC was not designed to effectively oversee adherence to functions and activities outlined in the PDBP RAP, including safety processes.

Finding: The RAC organizational structure did not permit the RAC Manager to work directly with the EAG.

The RAC sub-committee structure was designed to create separate sub-committees for systems integration testing, safety and security certification, and operations readiness. This structure requires close sub-committee coordination and effective oversight by the RAC.

According to the PDBP RAP, the Safety and Security Certification Review Subcommittee (**SSCRS**) was to monitor the design and construction certification; documentation of resolutions of safety hazards and security vulnerabilities; and certification of testing, training, documentation, pre-revenue operations, and all other safety certifiable items. The SSCRS members included representatives from Operations, DECM, SQA and Security. The PDBP SSCRS met as part of the project coordination meetings. The committee was to review and accept risks that were rated “Acceptable with Review”; assign appropriate project staff to resolve and conform to safety and security requirements; and elevate hazards with risk ratings of “Undesirable” and “Unacceptable”, or those that require additional budget to mitigate, to the SSDCC and/or to the Senior Oversight Approval Panel (**SOAP**) for evaluation. Final project certification required a recommendation from the SSCRS, through the SSDCC. The review team, however, did not find any evidence of the SSCRS elevating hazards to the SOAP or to the EAG for resolution. Nor did the review team find evidence of the SSCRS presenting the certification package to the SSDCC.

Finding: The safety hazard management process was not followed for the PDBP, as those hazards identified as “Undesirable” or “Unacceptable” were not elevated to the SOAP or EAG, respectively.

Finding: There was no apparent upward safety risk communication from the RAC sub-committees to RAC to SOAP to EAG, as outlined in the RAP and Agency SSMP.

Finding: Executive management’s validation and oversight of the PDBP overspeed hazard mitigation and the safety certification verification were limited to approval signoffs, without benefit of review briefings by staff.

Finding: PDBP documentation, as provided to the review team, lacks explanations or justifications for mitigating the overspeed hazard and for not completing the pre-revenue operations step of the SITP.

5.6 SUMMARY OF ALL GAP ANALYSIS FINDINGS

Table 2 below is a compilation of all findings identified through the full gap analysis.

Table 2. Gap Analysis Findings

GAP ANALYSIS AREA	GAP ANALYSIS FINDING
PDBP Contractual Relationships & Agreements	<ul style="list-style-type: none"> - The FRA requirement for a SSPP was satisfied through Sound Transit's Agency SSMP - The 2016 Sound Transit SSCP satisfied the safety certification plan component of the SSPP requirement. - Sound Transit was responsible for the testing and commissioning of the PDBP infrastructure. - WSDOT was responsible for coordination with Amtrak, including making available trainsets in order to ensure the functionality of the rail alignment. - Sound Transit was responsible for verifying the safety readiness of the rail alignment, in accordance with the Sound Transit Agency SSCP. - Sound Transit, as the owner of the railroad infrastructure between TR Junction and Nisqually, controlled all train movements throughout the Lakewood Subdivision through its train dispatching contract with BNSF. - Sound Transit retained a railroad consultant to work with BNSF in the development of a timetable for the completed Lakewood Subdivision. - The Service Outcomes Agreement did not, nor did any other agreement that was made available, outline any safety performance or safety oversight activities for the Amtrak or other passenger or freight service within the Lakewood Subdivision, from TR Junction to Nisqually. - Although the Agreement contained safety provisions for locomotives and rail passenger cars, it did not indicate that WSDOT would exercise any safety oversight activities, other than the reporting of incidents that affected service delays and passenger injuries. The oversight responsibility was that of Amtrak. - As a whole, the document is focused on the financial and service delivery aspects of the Cascade service, but does provide for minimally active safety oversight of Amtrak service. - The revised document requires on-board PTC in each locomotive.
Sound Transit Safety Management Plans	<ul style="list-style-type: none"> - Sound Transit requires modification of their agency-wide SSMP to reflect "project-specific plans, management structure, responsibilities and authority, schedules, activities, and tasks necessary to integrate safety and security into each phase of a specific (transit) project." - A project-specific SSMP was not prepared for the Point Defiance Bypass Project. (Section 1 of the Agency SSMP) - The unique management aspects of the Point Defiance Bypass Project were not captured in the Sound Transit Agency SSMP. (Section 2 and Section 3 of the Agency SSMP) - The Sound Transit Agency SSMP did not fully describe the approach to establishing the safety requirements and design criteria, including any standards used in the development of the requirements, for the Point Defiance Bypass Project. (Section 5 and Section 10 of the Agency SSMP)

GAP ANALYSIS AREA	GAP ANALYSIS FINDING
	<ul style="list-style-type: none"> - Sound Transit did not describe the process for training and qualifying Amtrak operations personnel, including the required core competencies, and the timeline to complete the training and qualification. (Section 6 of the SSMP) - Sound Transit did not specify the applicable rules and procedures, by name, in the SSMP. (Section 6 of the Agency SSMP) - Sound Transit did not identify their specific responsibilities as a host railroad of the Lakewood Subdivision. - The draft Sounder SSPP, dated December 2018, does not reference Sound Transit's responsibilities as a host railroad between TR Junction and Nisqually. - The lack of recognition of the Sound Transit host railroad responsibilities suggests there still is a misunderstanding of those responsibilities.
Sound Transit Hazard Management Process & Procedures	<ul style="list-style-type: none"> - The Sound Transit frequency definition does not align with transit industry practice. - The definition of severity and probability were not consistently applied in the PDBP PHA. - The mitigation measures in the PDBP PHA often do not support the safety risk ranking level of a hazard. - The OHA for PDBP was completed well after the start of revenue service.
Sound Transit's Safety Certification Process & Procedures	<ul style="list-style-type: none"> - The Operational Conformance phase of the Sound Transit safety certification process was not fully satisfied. - Conformance with the safety requirements for the signal system design was completed. - Conformance with the safety requirements for the track installation was completed. - All required testing is outlined in the Systems Integration Test Plan (SITP). - Sound Transit Safety, Sounder, and DECM staff believed that WSDOT was responsible for overseeing all activities related to Amtrak training and qualification. - The PDBP operational conformance checklist was limited to updating the Sounder rulebook and related SOPs; updating the Passenger Train Emergency Preparedness Plan; and requiring that contracted Maintenance of Way services were to be performed by qualified personnel. - Objective evidence of Amtrak staff training and qualification was not provided to or reviewed by Sound Transit. - There was no requirement for Sounder and Tacoma Rail operating engineers were to demonstrate re-qualification on the new bypass from Seattle to Tacoma. - FRA regulations require Sound Transit, as the host railroad, to certify the qualifications of all tenant operating personnel. - Pre-revenue simulated service was not fully performed, as required by the Agency SSMP, Agency SSCP, and RAP. - The PDBP timetable was not a requirement of the safety certification process. - The timetable did not require the Amtrak conductor to remind the engineer of the upcoming speed restriction at MP 19.8.

GAP ANALYSIS AREA	GAP ANALYSIS FINDING
	<ul style="list-style-type: none"> - Amtrak did not advise WSDOT or Sound Transit that the advance speed warning signs in the segment between Lakewood and Nisqually were not suitable for passenger train traffic.
Sound Transit's Internal Department Coordination for the PDBP	<ul style="list-style-type: none"> - The Sound Transit safety and security certification approval process was not followed for the PDBP. - The Project Certificate of Conformance was not signed by the Sound Transit CEO, as required by both the Agency SSMP and Agency SSCP. - The RAC was not designed to effectively oversee adherence to functions and activities outlined in the PDBP RAP, including safety processes. - The RAC organizational structure did not permit the RAC Manager to work directly with the EAG. - The safety hazard management process was not followed for the PDBP, as those hazards identified as "Undesirable" or "Unacceptable" were not elevated to the SOAP or EAG, respectively. - There was no apparent upward safety risk communication from the RAC sub-committees to RAC to SOAP to EAG, as outlined in the RAP and Agency SSMP. - Executive management's validation and oversight of the PDBP overspeed hazard mitigation and the safety certification verification were limited to approval signoffs, without benefit of review briefings by staff. - PDBP documentation, as provided to the review team, lacks explanations or justifications for mitigating the overspeed hazard and for not completing the pre-revenue operations step of the SITP.

6 SUMMARY & RECOMMENDATIONS

6.1 SUMMARY

The purpose of this incident review was to assess the December 18, 2017 Amtrak derailment, with an emphasis on the Sound Transit safety and security certification process utilized for the Point Defiance Bypass Project. The scope of this independent review included:

- Gathering PDBP information through interviews of Sound Transit management and staff and reviews of key PDBP and Sound Transit documents, including but not limited to safety plans, procedures, memoranda and meeting minutes.
- Identifying relevant Federal and State requirements and regulations, as well as current industry practices, applicable to the PDBP.
- Benchmarking the actual PDBP process to the industry requirements and current practices, and conducting a gap analysis to create a set of findings and identify any deficiencies in the PDBP.
- Developing a set of recommendations to Sound Transit to address actions needed before re-starting PDBP revenue service and to address deficiencies in Sound Transit's overall safety program.

The results of this incident review found deficiencies in Sound Transit's PDBP safety program management in three overarching and interrelated areas:

- Roles and responsibilities of the PDBP partners were not clearly defined.
- Sound Transit did not understand its responsibilities as the host/controlling railroad for the Lakewood Subdivision.
- Sound Transit did not follow its safety plans and procedures for the PDBP, as documented in its Agency SSMP, Agency SSCP and PDBP RAP.

6.2 RECOMMENDATIONS

Before re-starting PDBP revenue service, it is recommended that:

1. A formal, structured interagency PDBP re-start team be established that is comprised of Sound Transit, WSDOT, Amtrak, BNSF, Tacoma Rail, and FRA.
2. The re-start team, with Sound Transit in the lead role, should identify, monitor and certify/verify all needed actions are addressed and completed before PDBP territory service is re-started, including:
 - a. Update the timetable to include instruction for the conductor to warn the engineer of the speed reduction at MP 19.8.
 - b. Develop a speed limit action plan for MP19.8, in accordance with the Fast Act.
 - c. Consider placement of advance speed warning signs specific to passenger service operations.
 - d. Ensure PTC is fully-operational for the entire Lakewood Subdivision.
 - e. In coordination with Amtrak, BNSF, and Tacoma Rail, develop a back-up operations plan for use when PTC is not available.

- f. Update the PHA and OHA with appropriate risk ratings and advance them through the appropriate process for approval.
- g. Confirm through objective evidence the adequacy of Amtrak's, BNSF's, and Tacoma Rail's engineers and conductors training/testing program for the Lakewood Subdivision, including a complete understanding of back-up operations when PTC is not available.
- h. Receive from Amtrak, Tacoma Rail, and BNSF a list of personnel qualified to operate on the Lakewood Subdivision.
- i. Verify through objective evidence the qualification of signal and track maintainers for the Lakewood Subdivision.
- j. Develop a contractual agreement between Sound Transit and Amtrak to include authorization to oversee Amtrak safety performance, including the training program and qualification of operating crews, adherence to operating rules through efficiency checks and on-site inspections.
- k. Conduct full pre-revenue simulated service using the engineers, conductors, and equipment assigned to the service.

In addition to the specific recommended actions needed before re-starting PDBP service, the following actions are needed to address deficiencies in Sound Transit's overall safety program:

- 3. Engage consulting services to provide guidance on the responsibilities of a host railroad.
- 4. Update the Sounder SSPP to reflect the Sound Transit responsibilities of a host railroad in the Lakewood Subdivision.
- 5. At a minimum, annually receive the training and qualification records of all operating personnel for the Lakewood Subdivision, along with the list of qualified personnel.
- 6. Review and evaluate the tenant railroads' training and qualification programs.
- 7. Ensure the adequacy of contracted bus, paratransit, and light rail operators' training and qualification programs and require objective evidence of the programs, including re-qualification.
- 8. Improve Sound Transit safety staff's knowledge in the concepts of safety risk management and the methodologies for conducting hazard analyses.
- 9. Improve Sound Transit safety staff's oversight of safety consultants' work, to ensure consistency and alignment with Sound Transit's safety risk management approach.
- 10. Revise the definitions for safety risk frequency in accordance with industry practice.
- 11. Update the hazard risk matrix for all Sound Transit capital projects to align with industry practice.
- 12. Ensure the OHA is started with or made a part of the PHA during the Preliminary Engineering phase of a project.
- 13. Develop and implement a safety risk communication plan that assures safety hazards identified as "Unacceptable" or "Undesirable" are communicated to every level of the project team, including to the executive level.
- 14. Develop a certification status report and briefings that outline the level of certification for the project team and executive staff.

15. Expand the scope and responsibility of the RAC to include all activities needed to ensure the readiness of the project for service, inclusive of all operational aspects.
16. Establish a RAC organizational structure that permits the RAC Manager to work directly with the EAG when applicable.
17. Develop a project-specific SSMP annex for each project in which the safety requirements, project management structure and/or safety risk management approach differs from the Agency SSMP and Agency SSCP.
18. Define in the project-specific SSMPs clear roles and responsibilities for each external agency participating in a project.
19. Clearly define the scope of the certification program for those unique projects that are not captured in the Agency SSMP.
20. Close safety requirements through verified documented evidence, not just by relying on statements.
21. Ensure safety certification operational conformance requirements include those that are the responsibility of contracted operators, including the training and qualification of personnel.
22. Ensure the CEO, as the safety accountable executive, signs the System Certificate of Conformance, alongside signatures from DECM, Operations, and SQA, as required by the Agency SSMP and Agency SSCP.

ACRONYMS & DEFINITIONS

Table 3. Acronyms

ACRONYM	MEANING
APTA	American Public Transportation Association
ARRA	American Recovery and Reinvestment Act
BNSF	BNSF Railway Company
CEO	Chief Executive Officer
DECM	Design, Engineering and Construction Management
DHS	Department of Homeland Security
DoD	U.S. Department of Defense
EAG	Executive Action Group
ELT	Executive Leadership Team
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
MP	Milepost
NTSB	National Transportation Safety Board
OHA	Operational Hazard Analysis
PNWRC	Pacific Northwest Rail Corridor
PDBP	Point Defiance Bypass Project
PHA	Preliminary Hazard Analysis
PMP	Project Management Plan
PTC	Positive Train Control
RAC	Rail Activation Committee
RAP	Rail Activation Plan
SITP	System Integration Test Plan
SMS	Safety Management System
SOAP	Senior Oversight Approval Panel
SQA	Safety and Quality Assurance ²⁴
SSCP	Safety and Security Certification Plan

²⁴ Since the Amtrak derailment, the Sound Transit SQA Department changed its name to the Safety and Quality Management (SQM) Department. This report uses SQA for consistency with PDBP documentation.

ACRONYM	MEANING
SSCRS	Safety and Security Certification Review Subcommittee
SSCVR	Safety and Security Certification Verification Report
SSDCC	Safety and Security Design and Construction Committee
SSMP	Safety and Security Management Plan
SSP	System Safety Program
SSPP	System Safety Program Plan
TIGER	Transportation Investment Generating Economic Recovery
TSA	Transportation Security Administration
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

Table 4. Definitions

TERM	DEFINITION
Amtrak derailment	The Amtrak derailment from a bridge near DuPont, WA on December 18, 2017.
APTA Safety Manual	APTA's <i>Safety Management System Manual for Public Passenger Transportation Systems</i> , published in 2016.
APTA SSPP Manual	APTA's <i>Manual for the Development of System Safety Program Plans for Commuter Railroads</i> , published in 2006.
Effective operating control	Defined in FRA guidance as the railroad responsible for the installation and maintenance of wayside device and infrastructure, even if dispatching is the contractual responsibility of a different railroad.
Hazard	A real or potential condition or circumstance that can cause injury, illness, death, loss of equipment, property and environmental or reputational damage.
Hazard assessment	The classification of hazards/undesired events in terms of probability and severity, followed by the ranking of the hazard in terms of acceptability.
Host railroad	A railroad that has effective operating control over a segment of track.
Incident	An unforeseen event or occurrence with the potential to cause injury or property damage.
Joint operations	Rail operations conducted by more than one railroad on the same track regardless of whether such operations are the result of contractual arrangements, an order of a governmental agency or court of law, or any other legally binding directive (source: 49 CFR Part 240.7).
Major capital project	As defined in 49 CFR 633.5, a project that: (1) involves the construction of a new fixed guideway or extension of an existing fixed guideway; (2) involves the rehabilitation or modernization of an existing fixed guideway with a total project cost in excess of \$100 million; or (3) the Administrator determines is a major capital project because the project management oversight program will benefit specifically the agency or the recipient.

TERM	DEFINITION
	Typically, this means a project that: (i) generally is expected to have a total project cost in excess of \$100 million or more to construct; (ii) is not exclusively for the routine acquisition, maintenance, or rehabilitation of vehicles or other rolling stock; (iii) involves new technology; (iv) is of a unique nature for the recipient; or (v) involves a recipient whose past experience indicates to the agency the appropriateness of the extension of this program.
Mitigation	Sustained actions to reduce or eliminate or risk to people and property from hazards. Mitigation for transportations systems may include design considerations for rolling stock and facilities, training, and other activities or provisions that promote a safe and secure operating environment.
Risk	The likelihood of occurrence of a hazardous event, and the severity of the consequence associated with the hazardous event.
Safety	Freedom from unintentional harm to people, equipment, reputation.
Safety certification	The series of processes that collectively verify the safety readiness of a project for public use.
Safety risk management	The allocation of resources to identify safety risks and to achieve a condition where safety risks are managed to an acceptable level.
Security	Freedom from intentional harm to people, equipment, reputation.
Sound Transit	The Central Puget Sound Regional Transit Authority.
System	A composite of people (employees, passengers, others), property (facilities and equipment), environment (physical, social, institutional), and procedures (standard operating, emergency operating, and training), which are integrated to perform a specific operational function in a specific environment.
System safety	The application of operating, technical, and risk management techniques and principles to conserve life and property; prevent and reduce mishaps or incidents, and the effects which result; and to maintain a safe and healthful work environment.
Tenant railroad	A railroad, other than a host railroad, operating on track.

APPENDIX

A KICKOFF MEETING MINUTES

Point Defiance Bypass Project Incident Review

Kick-off Meeting Minutes

Date

Monday, July 8, 2019

By teleconference

Attendees

Sound Transit: Peter Rogoff, Mike Harbour

L&H Consulting: Harry Saporta, Rick Gerhart

Discussion Items

Mr. Rogoff kick-off the meeting by providing a brief overview of the entities that had an interest in the PDBP and who operated on the alignment. The entities included Tacoma Rail, BNSF, WSDOT, and AMTRAK, the eventual operator of the passenger rail service.

Mr. Rogoff also provided a brief overview of the NTSB Point Defiance Bypass Derailment report, which prompted a need for a review of the Sound Transit internal processes for the design and construction of the Point Defiance Bypass alignment. Mr. Rogoff identified the need to differentiate safety processes between projects where Sound Transit is the owner and operator vs. projects (like Point Defiance Bypass) where Sound Transit is the owner, but not the operator. He also asked that the roles and responsibilities of the personnel involved in the Point Defiance Project be assessed. Did they act in good faith? Were they able to have frank discussions with AMTRAK and WSDOT?

It was agreed that the contractual relationships between Sound Transit, WSDOT and Amtrak were of prime importance.

Project Tasks and Approach

The approach to the incident review is designed to address the issues that may have led to the derailment. The tasks include:

- **Project Document Review** - Review of project documents, but not limited to, SSMP, SSCP, contract with WSDOT, memos, hazard analyses, and other project documents that may be relevant to the review.
- **Sound Transit Personnel Interviews** – Personnel involved in the project design and construction phases will be interviewed. During this time assessments of their roles in the decision-making for implementation of any mitigations identified in the hazard analysis will be reviewed.
- **Safety and Security Certification Program Requirements** - Review of the regulatory requirements for conducting safety and security certification programs for commuter rail projects, and in particular host railroads, will be made. Harry Saporta stated FRA's 49 CFR Part 270 addresses the responsibilities of host railroads and the need for a process that confirms the incorporation of safety mitigations in design, construction, and operations. However, FRA has yet to issue a final rule and may impact the roles and responsibilities for host railroads with multiple partners.
- **Briefings and Report** – A weekly progress report, via teleconference, will be provided to Mr. Harbour. Near the end of the incident review, a briefing of findings will be held with Mr. Rogoff and Mr. Harbour. A written draft report will follow for Sound Transit review and comments.

APPENDIX

Project Schedule

Harry indicated meeting the proposed due date of 7/31/2-10 deadline for delivering the final report may be challenging, as the review progress is largely dependent on the availability of documents for review, Sound Transit personnel for interview, and any issues that may require further analysis. Mr. Rogoff stated that the objective is to deliver a quality report, even if it takes time beyond the initial 7/31 deadline.

Next Steps:

Harry Saporta will e-mail Mr. Harbour with a list of the requested documents (SSMP, SSCP, etc.)

Mr. Harbour will coordinate with Harry on scheduling Sound Transit personnel interviews. Harry stated that he would not be available Wednesday through Friday of next week.

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B DOCUMENTS REVIEWED

APPENDIX

- Sounder Commuter Rail System Safety Program Plan (SSPP), rev 7.0, December 2016
- Sounder Commuter Rail System Safety Program Plan (SSPP), drafted December 2018 to address 49 CFR Part 270 compliance; final version is pending FRA approval
- Sound Transit Agency Safety and Security Management Plan (SSMP), rev. 6, dated February 28, 2017
- Sound Transit Agency Safety and Security Certification Plan (SSCP), dated March 20, 2016
- Sound Transit Point Defiance Bypass Extension and Tacoma Trestle Track & Signal Projects Rail Activation Plan, dated September 11, 2017
- Systems Integration Test Plan Volume 1 Point Defiance Bypass, revision 1, dated October 20, 2016
- Safety Certification Verification Report (SCVR) for Point Defiance Bypass Track and Signals Improvements Project, dated October 17, 2017
- WSDOT Point Defiance Bypass 238.111(a) Test Plan for Cascade Equipment (approved by Sound Transit November 8, 2017; final report December 5, 2017)
- Final Report: 49 CFR 238.111(a) Pre-revenue Service Acceptance Testing Report for Sound Transit's Lakewood Subdivision (issued December 5, 2017)
- Cascades Equipment 238.111(a) Testing Procedures for Sound Transit's Lakewood Sub (PDB) (November 19, 2017 test results)
- Amtrak Long Distance Train Set 238.111(a) Testing Procedure for Sound Transit's Lakewood Sub (PDB) (November 22, 2017 test results)
- Sound Transit Point Defiance Bypass (PDB) Track and Signal Improvements Operating Hazard Analysis (OHA) (undated)
- Meeting minutes (from the period November 2016 to November 2017) for
 - Safety and Security Design and Construction Committee
 - Safety and Security Certification Review Committee
 - Senior Oversight and Approval Panel
 - Rail Activation Team
- Sound Transit letters to FRA (M. Young to R. Lauby) re: Sound Transit Response to FAST Act Action Plan: dated February 26, 2016 and June 28, 2016
- WSDOT and Amtrak Agreement RRB-1202 for the Provision of Rail Passenger Service (from July 1, 2019 to June 30, 2020), signed July 24, 2019
- WSDOT and Sound Transit Agreement RBB-1043 for High Speed Intercity Passenger Rail Program Construction and Maintenance effective June 30, 2016 (this agreement includes the PDBP)
- Amtrak -WSDOT Re-Entry to PDB Meeting Minutes, meeting date May 13, 2019NTSB Amtrak Passenger Train 501 Derailment Accident Report, May 21, 2019
- Sound Transit Status of NTSB Findings and Recommendations, undated internal document

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C INTERVIEW QUESTIONS

APPENDIX

This set of proposed interview questions is structured around the following inter-connected topic areas:

- An overview of ST's safety program and the scope of ST's safety roles and responsibilities for the PDBP
- The decision to start PDBP service without PTC operational and subsequent impact on the hazard analysis and mitigation process
- The ST safety certification verification process for the PDBP
- The inter-agency PDBP coordination between ST, Amtrak, WSDOT, FRA and BNSF

Questions

- 1 Please identify your respective roles and responsibilities in general and specifically for the PDBP.

Please describe the ST organizational structure and intra-agency agency coordination in place to manage and oversee the overall safety of ST, both on-going service delivery/operations/maintenance and major capital projects.

Please describe and identify the purpose of intra-agency and inter-agency coordinating committees created or in place needed to manage ST safety and specifically the PDBP?

Please describe and identify the purpose of ST safety-related plans programs and supporting documents (plans, procedures, meeting minutes, applicable regulations and industry reference/guidance documents, etc.)

Was there any consideration of postponing revenue service start-up until PTC was fully operational?

- a Did the ARRA grant funding deadline for completing the PDBP by December, 2017 influence the decision to start service (on December 18, 2017) w/o PTC operational?

At the September 28, 2017 meeting (when the decision was made to start service on December 18, 2017) did all parties clearly understand that PTC would not be operational?

Did Sound Transit consider their PHA as adequately identifying no PTC at start-up? If so, was this clearly communicated/understood by all parties?

- b Was Amtrak adequately represented and did they understand that no PTC at start-up required additional mitigation efforts?
- c Did Sound Transit know that Amtrak's mitigation effectiveness efforts extended to their engineers and conductors gaining experience on both new territory and new locomotives?
- d Did Amtrak provide Sound Transit with any feedback/recommendations based on pre-revenue testing?
- e What was the scope of the internal Sound Transit ELTR/SOAP review that resulted in the approval/acceptance of the hazard mitigation resolution?
- f As part of the PHA mitigations, why didn't Sound Transit update the timetable to add a crew focus zone for the curve at milepost 19.8?

Did Sound Transit complete the final steps of its safety certification process (system familiarization exercises and pre-revenue operations)?

- g Were plans developed to complete these final steps? If not, why weren't the plans completed?

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- h Did the plans include developing and approving an Operational Hazard Analysis (based in part on c) Amtrak's pre-revenue testing feedback) - instead of relying on the PHA throughout the entire life-cycle of the project?
- i Did these two final steps include adequate coordination with Amtrak & WSDOT?
- j Did the start date provide Amtrak with enough time for conducting training and testing (of engineers and conductors on both new territory and new locomotives), as part of the pre-revenue operations?
- k Was there ever any consideration or review of possibly postponing the start date (to provide more time for pre-revenue operations)?
- l Who was responsible for oversight of Amtrak's testing/training program for operational readiness? Did the scope of ST's safety certification verification include this? If yes, how did ST conduct and document its verification?

How much did ST rely on its existing Sounder safety program experience (and that service's contract with BNSF) for developing/managing the PDBP safety program?

How much did ST rely on WSDOT (through its contract with Amtrak for Cascades service) for developing/managing the PDBP safety program?

Does ST use the same safety program processes for all of its capital projects - whether or not the project is a ST owner/operator project – or a complex inter-agency project like the PDBP (where ST is the host railroad (but does not operate its own service on its territory) and Amtrak is the tenant/contract operator)? Is this documented in ST's safety-related programs plans/documents?

APPENDIX

D SOUND TRANSIT INTERVIEWEES

APPENDIX

- Salah Al-Tamimi (Chief Executive Safety & Quality Officer)
- Eric Beckman (Deputy Executive Director, Design, Engineering & Construction Management)
- Robin Braziel (Director, Commuter Rail, Bus and Paratransit)
- Peter Brown (Director, Systems Engineering and Integration)
- Erin Brumbaugh (Senior Transit Safety Integration Specialist)
- Weylin Doyle (Sounder Operations Manager)
- Mark Johnson (Sounder Project Director)
- Dale Lewis (Operational Senior Safety Manager)
- Bien Mai (System Safety Manager)
- Stephen Mischuk (System Safety & Assurance Supervisor)
- Jodi Mitchell (Rail Activation Manager)
- Javier Perez (Senior Safety & Quality Auditor)
- Mari Reilly-Hite (System Safety and Assurance Specialist)
- Robert Taaffe (Senior Construction and System Safety Manager)
- Bonnie Todd (Executive Director of Operations)
- Jordan Wagner (Senior Legal Counsel)
- Martin Young (Sounder Operations Manager)